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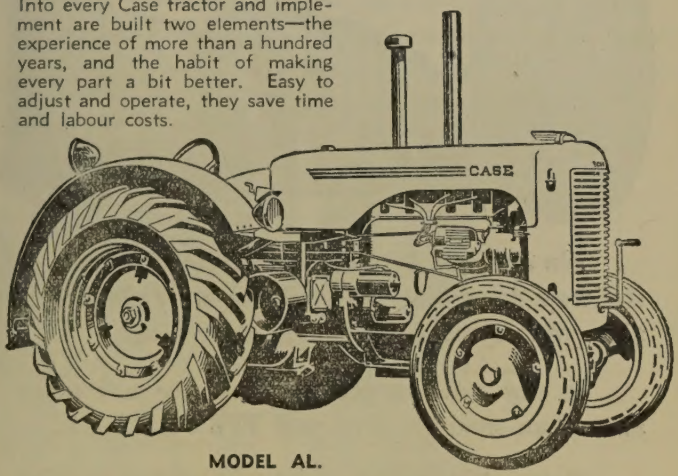

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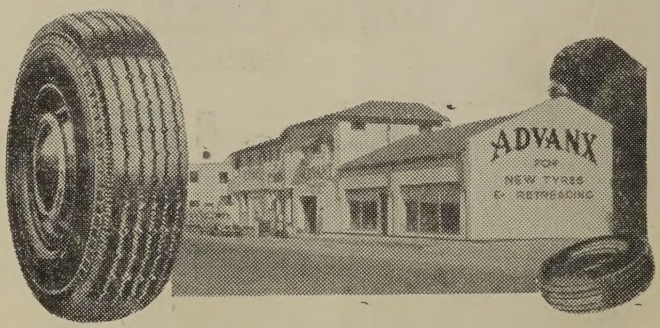

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Agricultural Journal

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Southern Rhodesia

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THE RHODESIA
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Editorial

Notes and Comments

ROTHAMSTED EXPERIMENTAL STATION REPORT, 1949.

This Report is obtainable from the Secretary, Rothamsted Experimental Station, Harpenden, England; price 5s. (foreign postage extra).

Included in this publication are the various Departmental Reports and details of the further work done on the Soil Survey of England and Wales. Work done in this connection has been confined to the areas reported on in the 1948 Report.

Two Special Reviews are published in the Report: (1) The Nutritional Problems in Forest Nurseries, and (2) The Relation between Soil Cultivation and Crop Yields.

A list of the Departmental Publications is given as well as the Publications of the Rothamsted Experimental Station.

MUSHROOM GROWING AND MUSHROOM INSECTS AND THEIR CONTROL.

This comprehensive Bulletin, written by Miss A. M. Bottomley and Dr. Bernard Smit, is obtainable from the Government Printer, Pretoria (Bulletin No. 210; price 1s.)

Miss Bottomley discusses the essential requirements for the successful cultivation of mushrooms, namely:—

(1) Fresh, good quality "pure culture" spawn from a reliable firm.

(2) Good, fresh manure from vigorous horses which are grain-fed and bedded on straw (preferably wheat straw).

(3) A suitable place in which to grow the mushrooms, where the necessary temperature, humidity and ventilation can be obtained and maintained.

The bulletin is well illustrated and contains diagrams of suitable mushroom houses, mushroom beds, etc. Full details on the production and marketing of the crop are also given.

In Section III Dr. Bernard Smit stresses the importance of absolute cleanliness during all stages of production, as mushrooms are susceptible to attack by insects and fungi. Control measures for these are given. Some simple recipes for cooking mushrooms, along with a table of their food value compared with other foods, are included in the Bulletin.

A DESCRIPTIVE LIST OF PLANT DISEASES IN SOUTHERN RHODESIA
and
LIST OF BACTERIA AND FUNGI,

by

J. C. F. HOPKINS, D.Sc. (Lond.), A.I.C.T.A.,
Chief Botanist and Plant Pathologist.

[Memoir No. 2 (revised 2nd Edition), Department of Agriculture, Salisbury; available at Government Stationery Office, Salisbury; price 4s.]

RETIREMENT OF Mr. D. D. BROWN.

One of the well-known personalities of the Department of Agriculture, Mr. D. D. Brown, retired recently.

In the middle of 1921 Mr. Brown arrived in Salisbury to take up duty as Assistant Tobacco and Cotton Expert.

Mr. Brown's activities in the earlier years included lecture tours and advisory work connected with both cotton and tobacco, and he also paved the way for the development of sugar growing.

As from 1930 his official designation was changed to Chief Tobacco Officer, and his duties were confined to matters pertaining to tobacco growing and marketing. He opened several tobacco experiment stations, the last being the Cigar Tobacco Experiment Station at Chipinga.

We wish Mr. Brown many happy years of well-earned retirement.

Some Notes on Freshwater Fishes in Southern Rhodesia

PART V.

By R. A. JUBB, B.Sc.

Tilapia sparmanni. Banded Cichlid. There are numerous species of the Family Cichlidae which do not grow to much more than six inches in length; this is one of them. Fresh from the water this fish is silvery green, darker on the back with seven to nine vertical bands. The dorsal fin is edged with pink and a distinctive feature is a black spot at the base of the beginning of the soft portion of the fin. The tail is truncate or slightly rounded. The irridescent colourings and the smallness of this fish make it a popular aquarium species. Getting down to harder facts of life, it is also recommended and bred as forage food for predatory species. During the breeding season the bars become very dark, almost black, and brooding pairs can easily be detected about a foot below the surface in clear water amongst the water lilies. The fry are minute, but can usually be spotted when the shoal moves.

Tilapia sparmanni is not a mouth breeder. Mr. S. S. du Plessis,* of the Jonkershoek Inland Fisheries Department, has studied its breeding habits and he writes as follows:—

"At Jonkershoek the breeding of *Tilapia sparmanni* commences in October, when the water temperature rises above 60°F. The dark coloured, elongated eggs are laid on stones, roots and stems of aquatic plants, or on the hard pond bottom. Both parents guard the eggs, but the female is more active than her mate. As they hatch, the young are picked up in the mouth and deposited in a small pit which has previously been constructed in the pond bottom. Using a series of three pits, one pair was seen to shift the young from one to the other about once every 24 hours.

"In the pits their tails are in constant vibration to ensure circulation of the water. At the back of the head is a marked prominence formed by two pairs of cup-shaped glands which secrete a colourless, sticky substance. This enables the little fish to anchor itself to the bottom of the pit. This is necessary on account of the constantly vibrating tail. When the small fish starts swimming these glands disappear.

*Observations on the Habits of *Tilapia sparmanni*. S. S. du Plessis, M.Sc. Inland Fisheries Department Report No. 2.

"After they leave the pit the young fish swim about in a shoal guarded by both parents, whose markings now become more distinct. When danger threatens, the parents give the sign to the fry by sudden jerks of the body which sends them to the bottom, where they swim around apparently unconcerned. When the parents leave them to chase off enemies, the whole shoal rotates in a characteristic fashion, keeping close to the bottom."

Preserved in formalin there is a great similarity between young *Tilapia melanopleura* and *Tilapia sparmanni*, even to the dark spot on the dorsal fin and the gill-raker count. Freshly caught, *T. melanopleura* have a characteristic pink flush on the throat and belly.

Marcusenius discorhynchus. This species, another of the Family Mormyridae which consists of queer types such as the "Bottlenose" and "Cornish Jack," does not grow to much beyond eight inches in length. Its natural colour is silvery yellow; the blotches seen in the photograph developed after the specimen was put into formalin. The scales, like those of the rest of the family, are very small. This species is common to the Zambesi River system and the rivers and lakes of Central Africa and is netted in large numbers, gutted and smoked for African consumption.

Schilbe mystus. Silver Barbel. This small barbel-like fish belongs to the Family Schilbedae, and although common to the Zambesi River system, has not been found south of it. In length it does not exceed 12 inches and is very light in colour with a broad darkish lateral band; there are no scales. The droop of the tail is characteristic. Although small, this fish is of great food value and is eagerly sought after by Africans for its fat. A closely resembling species of the same family is *Eutropius depressirostris*, which is found in rivers as far south as in the Transvaal; this latter species has an adipose dorsal fin and can therefore be distinguished quite easily from species of Schilbe.

Distichodus mossambicus. This fish is a member of the Family Characinidae, and, although there is no resemblance, is a relative of the "Tiger-fish." Its habitat is the Zambesi River, particularly the Victoria Falls area, where specimens of up to 3½ lb. have been caught. In shape the fish is very deep and even the largest do not exceed 12 inches in length. Fresh from the water it is silvery yellow in colour with a blueish sheen along the back and partly down the sides forming vertical bands. The fins are pale yellow and the forked tail has a dark edging to the inner portion of the lobes. Characteristic features are the very small scales and the adipose dorsal fin.

Labeo cylindricus. Mud-sucker. A widely distributed species of the family Cyprinidae, the genus owes its name to the well-developed lips which are a characteristic of the species. The mouth is described as inferior and the lips form a sucker with

Banded Cichlid (*Tilapia sparmanni*).

Marcusenius discorhynchus.

Distichodus mossambicus.

Silver Barbel. (*Schilbe mystus*).

Mud-sucker. (*Labeo cylindricus*).

which the fish dredges the muddy bottom and sides of rocks for food. This sucker-like mouth is also used for clinging to rocks when the fish migrates up stream against strong currents; it is this species that fights its way up the Prince Edward Dam wall against the water that sweeps so many other fish back. In colour it is slate grey on the back with light belly; the scales are large.

Although this particular species does not grow to much more than 12 inches in length, some members of the genus, when mature, are much larger. The "Gorge Fish," *Labeo altivelis*, which is caught below the Falls and, incidentally, in the Hunyani River, where it is known as "Hunyani Salmon," runs to about 7 lb. in weight.

Subsoiling in Relation to Agriculture

By K. J. MACKENZIE, Senior Extension Officer, and
R. M. M. CORMACK, Senior Conservation Enquirer,
Department of Conservation and Extension, Southern Rhodesia.

Descriptive.

The agricultural operation known as subsoiling or chiselling consists of dragging a heavy rigid tine implement through the soil so that it penetrates and shatters the surface and subsoil to as much as 24 inches.

Depth.

Subsoiling is a tough and expensive job, the cost depending largely on the depth of penetration, consequently this would be limited to just the depth that is required to attain the desired result.

If the purpose of the subsoiling is to increase penetration and absorption as much as possible, either for the purpose of storing water, or to improve downward drainage, then penetration would be as deep as possible.

If, on the other hand, the purpose was to shatter plough or natural pan, little advantage would be gained by going deeper than the pan, and nine to twelve inches penetration might do as much good as 24 inches at a cost of only half as much.

To decide what depth is justified it would be logical to sink a few test holes, so that the soil horizons could be examined to determine just whether subsoiling is necessary, secondly how deep this should be, and thirdly whether the soil is in such condition that the maximum fracturing effect will be obtained.

Uses of Subsoiling.

In areas where rainfall is the limiting factor, it is probable that subsoiling would increase the penetration and therefore the water holding capacity of soils considerably where conditions were suitable. Little experimental work has yet been carried out on these lines, but one series in U.S.A. showed that a 20-minute rain of .65 inches penetrated to from 20 to 50 inches on subsoiled land and not more than 12 to 14 inches on untreated land.

1. It may be assumed therefore that in areas of lower rainfall it would enable plants to make the greatest possible use of the rainfall, and to withstand the maximum amount of drought by deeper rooting.

2. In areas of high rainfall, particularly where soils have an impervious layer near the surface, due to plough pan or natural

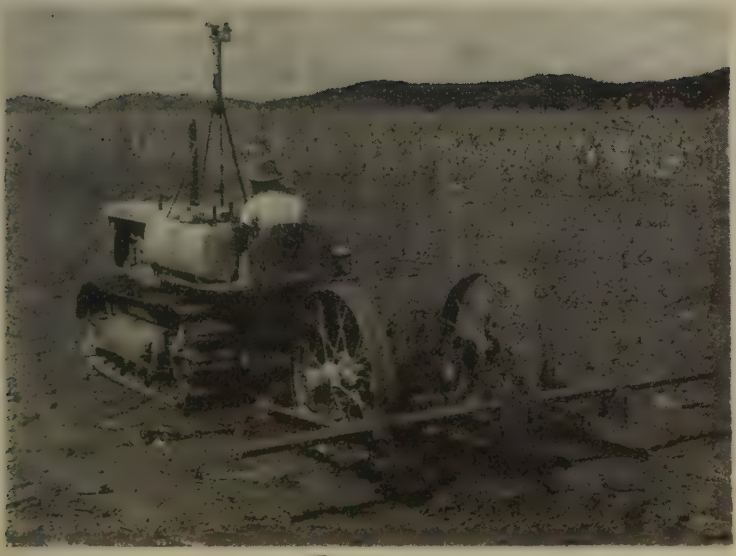

Figure 1.—A good example of a balanced unit of the tool bar type.

Figure 2.—Note the good shattering effect and the bulge in the soil indicating maximum effect below.

Figure 3.—Denuded grazing land after ripping. If the lines had been closer and the depth reduced results would have been better and cost the same.

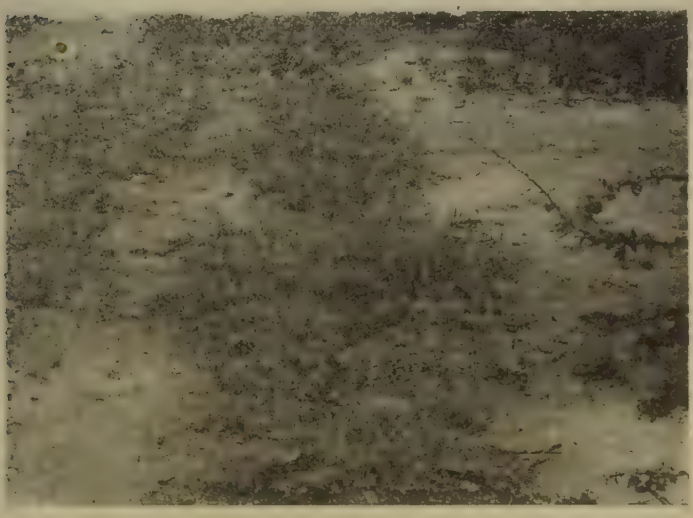

Figure 4.—Grass establishing itself and spreading along the ripped lines. Each line acts as a filter strip and traps both seed and soil, while the fractured sub-soil enables plants to resist drought by penetrating deeply.

causes, or where the land surface is hard and compact, the effect would be firstly to increase the absorption of water, secondly to increase the feeding area of plant roots, and thirdly to facilitate aeration and the growth of soil bacteria.

3. It simplifies preparation of the land by loosening up compacted soils, gravel and stones, and by breaking tree roots.

4. It decreases runoff and therefore peak floods, and this helps to reduce the risk of over topping and damage to conservation works.

5. It loosens up the soil to below plough depth, without bringing the subsoil to the surface or burying the trash mulch.

6. It goes far to renovate old pastures by loosening up and aerating the roots, and by breaking up the compacted surface of the ground allows better absorption and penetration of rain and roots without destroying the surface cover.

7. It is one of the most satisfactory methods of re-establishing grass on areas completely denuded by over-grazing, etc., and with a compacted surface. See Figures 3 and 4.

8. When done by means of dynamite it greatly increases both growth and survival of fruit trees where subsoil conditions justify the measure.

9. Where lands have been cultivated for many years, or where irrigated lands have become **sealed with silt,** penetration is poor and waterlogging frequently occurs during prolonged wet spells.

Subsoiling, by loosening up the surface and subsoil, improves penetration and downward drainage and decreases the tendency to waterlog.

Implements.

The increase in the use of tractors during and since the Second World War has resulted in the development of a great variety of implements for subsoiling and chiselling. With the exception of the ox-drawn pick point or rooter plough all these are designed for tractor operation and are generally either of the hydraulic or self-lift type. Subsoiling is a tough job and implements require to be of heavy and rugged construction to stand up to the work. Implements range from the simple wheelless pan breaker and mole drainer absorbing 15 h.p. to the giant rippers with up to seven times penetrating two feet and taking 120 h.p.

A number of well-known firms now produce a standard type of wheeled chassis or tool carrier, on which can be mounted attachments for pan breaking, subsoiling, mole draining, ditching and listing.

The so-called trash farming has induced some firms to produce a chisel cultivator, cutting from six to 10 feet in width, with a penetration of from nine to fifteen inches, which is said to eliminate ploughing, and to produce an equally good seed bed quicker and

with less labour, when followed by a one-way or offset disc, leaving all the trash on or near the surface.

In choosing your implement see that it is suited to the power of the tractor; a nice balance between the strength of the implement, the draft and the power of the tractor is essential for the best results. See that the implement has ample clearance and an effcient self or hydraulic lift system.

Type and Condition of Soil.

No one would expect significant results from subsoiling sea sand or soft plastic clay, so it will be appreciated that to be beneficial both the type of soil and the condition of the soil is very important.

Although little experimental work has been carried out locally it would appear that soils which have a compacted or hard clay or gravel pan below the surface would respond most satisfactorily to subsoiling. There would probably be little result on either granite sand or black clay soils.

The former is seldom dry enough and in any case does not fracture well, and the latter expands so much when wet that it might be expected to swell and fill all the cracks the first time it became wet enough. The exception in all cases would be if hard pan or a hard compacted surface were present when breaking it up would no doubt produce temporary beneficial results.

If the granite sand were overlying quartz rubble the response might be better, as this is often so cemented together as to constitute a hard pan, the breaking up of which could hardly fail to do good.

Before embarking on a large subsoiling scheme therefore, ask yourself and find answers to these questions. What am I subsoiling for? How deep should I go? Will the results justify the cost in my soil? Is the soil dry enough to get the maximum result? When you have satisfactory answers, go ahead with an experimental acreage the first year.

Pasture Subsoiling.

From observations made lately, it is beginning to be felt that where soil conditions are favourable, subsoiling may be preferable to pasture furrowing, and although more expensive this might be justified by the better and more lasting effect.

With pasture furrowing a considerable amount of turf is destroyed, it is difficult to make good banks and furrows when the soil is hard and dry, as is so often the case where furrows are required, and the furrows are shallow and liable to breakage with heavy rain before they are settled. Subsoiling obviates all these defects and in addition provides for deeper penetration of water and the aeration and loosening up of the roots.

It is felt that where an effective job of subsoiling has been done under good soil conditions, at least an equal amount of water is held up, and since it is held underground it is less subject to loss by evaporation.

Where bush encroachment is a problem this is likely to be increased rather than improved by subsoiling, because many plants mainly of the Acacia family, produce a new sapling each time the roots are broken, and a regular forest of new young trees may appear along the subsoiled lines the following year.

Width Apart.

The frequency or width apart of the lines depends to some extent on the depth of penetration, but mainly on how well the soil fractures. When the work is going on the movement of the soil surface and the amount of upward bulge along the lines gives some indication of over what width and how effective the subsoiling is. Generally from three to five feet is satisfactory for deep penetration and from twelve to eighteen inches for chiselling for plough pan, or as a substitute for ploughing.

Try a small experimental area before launching out on a large acreage. A few hours of practical work will soon show up the difficulties and after the first rainy season the results.

Warning.

1. On certain soils with a high clay content, subsoiling too near the edge of a gully will often promote subsoil erosion, and cause large stretches of the banks to become undermined and to slump into the gully.

Care should be taken, therefore, to keep well clear of the head and sides of gullies, when soil is cracked and conditions are such that subterranean erosion is likely. An allowance of thirty feet in ordinary soils and sixty feet in heavy clay soils would not be too much.

2. As has been mentioned before, in acacia or thorn tree country it is common to get a profuse regeneration of young plants along the subsoil lines either from seed or from sucker growth from the broken roots. Such growth (if widely enough spaced) might conceivably form useful barriers across steep slopes, but could lead to a most vicious form of bush encroachment if closely spaced and allowed to develop undisturbed.

3. To avoid damage to the subsoiler or tractor on striking rock, a spring hitch or shear pin should be used in the coupling, and it should be noted that the risks increase with the speed. Better safe and slow with a normal load than fast and risky with an overload.

Notes on Trees of Chirinda Forest, Mount Selinda

By R. B. HACK, Warden.

Chirinda, or Mount Selinda Forest, is an area of 1,749 acres of evergreen high forest in the Chipinga District. Of this area, 1,274 acres on Gungunyana and Mount Selinda farms are owned by the Government and reserved as a National Park.

This forest is situated some 23 miles south of Chipinga at an altitude of about 3,400-4,000 feet. The average annual rainfall over a 30 year period is 60.22 inches.

Descriptive notes on trees numbered in the Forest are given below.

SAMYDACEAE.

No. 1. *Casearia chirindensis* Engl. (Native name: Muhwahwati).

One of the largest trees of Chirinda Forest, growing up to three feet in diameter. The leaf is simple, alternate, glabrous and serrate, and the bark, which is rough, is of a light colour. The tree flowers during November. The timber is soft and white.

No. 2. *Oricia swynnertonii* (Bak.f.) Verdoorn. (Native names: Ruanziti, Munyabangwa).

A medium-sized tree with dark, glossy, evergreen, gland-dotted, aromatic, tri-foliate leaves. It flowers during October. The fruit, which is an orange-coloured berry, ripens during September and October. It is eaten by natives, baboons and trumpeter hornbills. It is probably the local food-plant of the butterfly *Papilio dardanus*.

No. 2A. *Fagara* sp. (cf. *F. macrophylla* Engl.) "Knobby Bark." (Native name: Mulungwana).

A large tree up to 80 feet high and 30 inches to 36 inches in diameter. The leaf is compound pinnate with a thorny petiole, light green, glabrous. In the young sapling the trunk is covered with thorns and as the tree matures these thorns change into knobs, hence the name "Knobby Bark." The wood is lemon coloured and when planed gives off a pleasant aromatic smell. A very fine cabinet wood.

MELIACEAE.

No. 3. *Khaya nyasica* Stapf. (Native name: Muvava, Mbawa).

The famous "Big Tree" of Chirinda, which is about 200 feet high, is a *K. nyasica*. Its strongly buttressed base measures

approximately 14 feet in diameter. Although the Khayas of Chirinda are the largest of the forest trees they are, however, not very plentiful, and there are probably not more than 300 over a foot in diameter in the entire forest. There is, however, a patch where 10 large trees over 150 feet high can be seen from a single vantage point. This spot is known locally as "The Valley of the Giants." The pinnate leaves are dark glossy green and about six inches in length, though in the case of young trees struggling in the shade of the forest the leaves are up to three feet in length. The flowers, which are small and white, appear during November. The fruits are four-celled capsules from one to two inches in diameter, and each capsule contains several flat, wafer-like seeds of a reddish brown colour. The wood, one of the mahoganies, assumes a darkish red colour on exposure and is an excellent furniture wood. Fallen trees, if left lying in the forest, will rot during a period of three to five years. Except for the sapwood the timber is not readily attacked by borers, but termites will eat it if it is left unprotected and exposed to them. The natives along the Buzi River in Portuguese East Africa use Khaya almost exclusively for making their dug-out canoes.

No. 4. *Lovoa swynnertonii* Bak.f. (Native name: Muvava).

This tree is known locally as the Brown Mahogany, and in general appearance closely resembles *K. nyasica* and the two trees con be readily confused in the forest. It grows to a height of 160 feet. The leaf of the Lovoa is pinnate but much smaller than that of Khaya. The margins of the leaflets are wavy. The Lovoa appears to prefer parts of the forest which are drier than those favoured by Khaya. The flowers, which appear during January, are white and produce small, elongated, four-celled seed capsules containing two winged seeds in each cell. Lovoa does not produce seeds every year. The very attractive light to deep brown wood produced by this tree has a wavy grain and is very durable. Trees which have fallen in the forest probably about 50 years ago are found to have sound heartwood.

No. 5. *Trichilia chirindensis*, Swynnerton and Bak.f. (Native names: Mukuthlu mutsikiri).

This is a very large tree which is found with breast height diameters up to five feet. It is a common tree in this forest and can be identified by its crown of dark, glossy, green imparipinnate leaves, and somewhat scaly bark. The flowers are a yellowish white and the fruit a four celled capsule containing black seeds with red arils. An edible oil is extracted from the seeds by the natives. The somewhat soft uniform timber is of a light orange colour and is useful for such a purpose as flooring but is apt to be attacked by borers if untreated.

OLACACEAE.

No. 6. *Strombosia* sp. (Native name: Mutsahwari).

This is a large tree which occurs commonly in Chirinda Forest. It is easily identified by its bark which is a dark brownish grey

colour which tends to flake off in irregular patches, thus leaving patches of a lighter colour. The leaves are simple, alternate, glabrous and entire. The fruit is a rough grey-coloured one-seeded drupe. The timber is hard heavy brittle and of a slaty red colour.

PAPILIONACEAE.

No. 7. *Craibia brevicaudata* (Vatke) Dunn. (Native name: Mushamba).

A medium-sized tree seldom reaching 100 feet in height and two feet in diameter at breast height. It is one of the commonest trees in this forest. The leaves are pinnate, the glossy-green, entire, pointed leaflets being arranged alternately on the petiole. The bark is scaley, indented and of a dirty yellow colour, giving the trunk a characteristic and easily recognised appearance. The flowers which appear in September give the forest top a white appearance. The fruit is a large pod, the pods from the previous year split on the trees with a loud crack shortly after the flowers appear. The wood is very hard and difficult to split. Owing to its hardness and liability to be attacked by borers the timber is not used.

MIMOSACEAE.

No. 8. *Piptadenia buchananii* Bak. (Native name: Mufumoti).

The mufumoti is a large tree up to four feet in diameter at breast height, which is common in the moister parts of Chirinda Forest. The leaves resemble those of the wattle. The characteristically smooth grey bark has horizontal red-brown stripes. The flowers which appear in October are of a cream colour in elongated spikes. The pods are thin, smooth, and about three inches long and contain oblong winged seeds. The wood is soft and whitish to pinkish or golden brown in colour. Logs are apt to split after felling and therefore are best sawn on a frame saw. It is subject to attack by borers.

No. 9. *Albizzia gummifera* (Gmel.) C. A. Smith. (Native name: Mujerenje).

This is a large flat-crowned tree not seen in the depths of the forest but common on the outskirts of Chirinda. The trunk, of a light colour and smooth, is found up to two feet in diameter at breast height. The leaf is bipinnate with leaflets rhombic and acute to obtuse at the apex. The mature pods are of a brownish colour and up to about six inches long by a little over an inch wide. The wood is tough and of medium hardness, the heartwood being of a yellowish colour. It is a useful wood for a number of purposes.

ROSACEAE.

No. 10. *Parinari gilletii* De Wild.

This is a large and rare tree in the forest. It grows up to four feet in diameter at breast height. No local native name for this tree is known. The trunk resembles that of *Khaya nyasica*

and the fruits bear a close resemblance to those of *Parinari mobola* (Muhatja) of Mashonaland. The timber is of a dull red brown colour and is exceedingly hard and heavy.

ARALIACEAE.

No. 11. *Polyscias malosana* Harms. (Native Name: Mutengambia).

This is a very tall tree, the sapling of which somewhat resembles that of Khaya. The trunk is of a light grey colour and bears the marks of leaf scars and the mature tree branches at the top like a large candelabra. The leaves are pinnate, the leaflets being glabrous above, densely orchraceous tomentose beneath and tough and cloth-like to the touch. The timber is a soft white uniform wood and seasons well. Inch planks can be successfully air dried within six months.

SAPOTACEAE.

No. 12. *Chrysophyllum fulvum* S. Moore. (Native name: Umhlanchwa).

A large, tall tree easily recognised by its smooth, russet red trunk, which is usually very deeply fluted at the base. The leaves are simple, alternate, entire and coriaceous. They are dark green and glossy above and have a brownish pubescence beneath. The silvery bronze effect on the under side of the leaves simplifies the recognition of this tree. The fruits resemble small russet coloured potatoes and contain shiny black seeds. The timber is a light orange colour, uniform, free from knots and semi-hard.

EBENACEAE.

No. 13. *Maba mualala* Welw. (Native name: Munyamakungu).

A large, tall straight tree up to two feet in diameter at breast height and 150 feet in height. The bark is scaly and black. The small dark leaves are simple, entire, alternate and glabrous. The fruit is a small black berry. The timber is very hard with black streaks in the heartwood. It is attacked by borers if untreated.

APOCYNACEAE.

No. 14. *Rauvolfia inebrians* K. Schum. (Native name: Muzungurwi).

A large tree up to four feet in diameter with a rough, light grey bark. This tree does not grow very tall and prefers the out skirts of the forest rather than the depths. It grows easily as transplanted saplings up to two feet high. The leaves are in whorls and are simple, elongated and end in a sharp point. The small white flowers appear in early October. The fruit is a small black berry. The timber is a useful soft white wood. The Rauvolfia makes an easily-grown and handsome ornamental tree.

No. 15. *Conopharyngia usambarensis* (K. Schum.) Stapf. (Native name: Mukathlu).

A small tree with a crooked stem which is common in the undergrowth at Chirinda. The leaves are oblong to linear oblong.

The white flowers, which appear in October, are a conspicuous feature of the forest at that time. The dark green egg-shaped fruits hang in pairs. This tree is of little value, being used to a limited extent only for firewood and building of native huts.

LOGANIACEAE.

No. 16. *Strychnos mitis* S. Moore. (Native name: Mtamba-bungu).

One of the largest trees in Chirinda Forest, being found up to 3½ feet in diameter and 150 feet in height. The smooth trunk is of a greyish green colour and has a thin bark. The trunk has a gnarled appearance resembling somewhat the muscles of the arm when the fist is clenched. The leaves are simple, opposite, entire, glabrous, tough and dark green. The flowers are creamy-yellow and appear during January. The fruit is a small yellow berry. Although seeds are produced abundantly this tree appears not to reproduce itself readily, and the fact that blue monkeys and hornbills are fond of these may be accountable. The timber is hard and heavy and very resistant to nails when seasoned. It is a useful building timber but must not be exposed to damp.

No. 17. *Strychnos mellodora* S. Moore. (Native name: Chi-tonga).

A medium-sized tree seldom reaching more than 18 inches in diameter and 100 feet in height. The trunk is straight and has a clean appearance except for small protruberances which give it the appearance of being divided into fine horizontal lines. The bark is yellow when exposed by the cut of an axe. It is easily recognised by its leaves, which are dark green, simple, entire, opposite, glabrous and leathery. The minute white flowers come out in September and the yellow-berried fruits strew the forest floor in February. These fruits have a bitter taste and do not seem to be liked by either monkeys or birds. The tree is hardy and natural regeneration is prolific. The heartwood is of an orange yellow colour streaked with black. The wood is hard and close-grained. It is apt to warp and crack during drying. It is a good cabinet timber.

No. 18. *Anthocleista zambesiaca* Bek. (Native name: Garuro).

A tall tree with a crown of very large leaves. This tree grows to about 18 inches in diameter at Chirinda. It is not very common. The trunk is light grey and smooth except for old leaf scars. The wood is soft and white but has not been cut for timber at Mount Selinda.

EUPHORBIACEAE.

No. 19. *Croton sylvaticus* Hochst. (Native name: Musukuta).

This is the well-known "Mount Selinda Linden." It is a tree with a spreading crown and is one of the few deciduous trees of the forest. The bole is light grey and rough. In the mature tree, which is up to three feet in diameter, the bole is marked by vertical

stripes of a darker colour. Trees Nos. 1 and 14, mentioned above, have bark similar to *C. sylvaticus*. The trunks of these three can be confused. The leaves are simple, heart-shaped, alternate, hairy, soft-textured with a long petiole. The flowers are in spikes and the female flowers are scattered among the male flowers. The fruits are of an orange-red colour and are showy. The timber is a soft white wood flecked with black specks and is very apt to be attacked by insects if untreated.

No, 20. *Macaranga mellifera* Prain. (Native name: Mufukusha).

A large tree up to 30 inches in diameter and 120 feet in height. The leaf is heart-shaped like Croton but much larger. Mature trees of this species are not very common in Chirinda. It has not yet been cut for timber at Mount Selinda.

No. 21. *Tannodia swynnertonii* (S. Moore) Prain. (Native name: Munyabotabota).

A small tree with a fluted trunk about nine inches in diameter. The leaf is dark green, simple and heart-shaped. It is very common in all parts of the forest but is cut only for firewood. Owing to being usually too small for use as timber.

ULMACEAE.

No. 22. *Celtis durandii* Engl. (Native name: Guiniti). Chirinda Stinkwood.

This is a large forest tree. The bark is grey-green in colour and with a texture like rough sandpaper. The trunk is strongly buttressed at the base. The stems of young trees are flecked with light coloured specks. The leaves are simple, soft serrate (upper portion) and covered with fine hairs. The timber is hard, strong and durable, but it is not used on account of its objectionable smell. This odour is retained by the cut timber for years. Not to be confused with the Stinkwood of Knysna.

No. 23. *Trema guineensis* (Schum. and Thonn.) Fichlho. (Native name: Mugubvuru ?).

A medium-sized tree with leaves similar to those of Celtis but more completely serrate. The flower is greenish and not very conspicuous, and the fruit is a small black drupe. This tree grows freely inside as well as outside the forest. It is a fine ornamental tree with a soft white timber.

MORACEAE.

No. 24. *Ficus* sp. (cf. *F. brachylepis* Welw. ex Hiern). (Native name: Mutsamvu).

This is the common parasitic fig tree of Chirinda. The tree which probably germinates from a seed which lodges in a crack in the bark of other trees, grows round the trunk of its victim like a large boa constrictor. In its final stage this fig tree forms a

network round the host which eventually dies, leaving the fig tree in its place. Some of these fig trees stand 150 feet high and up to eight feet in diameter. The trunk has a latticework appearance and a hollow centre after the host tree has rotted.

No. 25. *Myrianthus holstii* Engl. (Native names: Muteswa, Bgambgambga).

A medium-sized tree with large palmate leaves, each with five to seven leaflets somewhat resembling those of the horse chestnut tree. The infructescence is about two inches in diameter and is edible.

Herons and Egrets

By D. C. H. PLOWES,
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Rhodesia, because of its thick mantle of bush, and lack of streams, marshes and open water, is not as attractive to members of the heron family as is the Union of South Africa. We probably have as many representatives of this group here as there are in the south, but we lack the quantity. Apart from their economic value, they are birds of considerable aesthetic appeal, and they deserve every encouragement in an effort to increase their numbers.

To-day herons are afforded general protection, but in the middle ages they frequently graced the tables of nobility, and provided quarry for falconers. A generation ago, the white egrets were verging on extermination in several countries, particularly in America, due to the demand for the plumes from the breast and back, known as aigrettes, for use in ladies' millinery. The parents used to be killed in the breeding season, just for the sake of these few ornamental feathery plumes, resulting in the nests being left unattended and the chicks starving to death. To-day these birds are strictly protected, and their numbers are now slowly increasing.

A few years ago, heated controversy raged in the pages of South African farming journals, over the merits or otherwise of some of the larger herons. As with all our birds, very little intensive work has been done as yet on the feeding habits and economy of herons. A recent article in the "Ostrich," the journal of the South African Ornithological Society, has helped to throw some authoritative light on the subject, but much more research still remains to be done. This article contains the result of much patient observation by Mr. J. Sneyd Taylor on a colony of Black-necked Herons (*Ardea melanocephala*) at Fort Beaufort in the Cape. The Black-necked is among the largest heron commonly to be seen in Southern Africa. It is a bluish-grey colour, with a slate-grey back and wing flight-feathers. Its name is derived from the blackish head and neck, which contrasts markedly with the nearly white throat. The long legs and sharply-pointed bill are characteristic of the family, and have been evolved in response to the birds' mode of life. In the Union, he is equally at home stalking over lands in search of mice, locusts and other large insects, or standing in the reeds and sedges of a shallow vlei, ever on the look-out for frogs, fish and other water-animals.

Analysis of the food consumed by these birds is facilitated by the fact that they regurgitate the hard and indigestible portions of their prey in the form of pellets, and it was largely by this means that Mr. Taylor was able to deduce what constituted the bulk of their diet. Digestion of bones is more complete in this group than is the case with owls, where whole undamaged skulls

can be found in the castings, and from which the exact identity of the species can be determined.

From an examination of 200 pellets, Mr. Taylor found that insects' remains occurred in 91 per cent. of the castings; mammals occurred in 61 per cent., and reptiles (including amphibians) were found in 59 per cent. Bird remains (probably nestlings) were much less frequent, being noted in only 9.5 per cent. of the pellets. Earthworms, scorpions and spiders were present in about 4 per cent. of the pellets.

In addition to this method of estimating the diet, Mr. Taylor was also able to procure specimens from below a nesting colony, which had been brought back by the adult herons and then dropped. From all these observations, he was able to definitely deduce that these birds play a useful role in agriculture, and that this more than nullifies any harm they may do in taking nestlings or other beneficial items.

The Black-necked Heron, in common with many others of the family, nests in colonies in marshes or trees. The trees most favoured are willows and poplars, especially when they are near water. As a rule, several species will be found nesting together, and there may be several hundred nests in all. Such colonies are known as heronries, and are used year after year. They are easy to locate, as there is a constant stream of birds backwards and forwards from the feeding grounds, which may be spread over a radius of five miles or more. Herons and egrets, and in particular, their chicks, are noisy creatures at the nest, and they keep up a continual croaking and clapping of bills, which may be heard several hundred yards away. The nests are made of twigs in the form of a shallow dish, and they are lined with leaves. Three eggs is the usual clutch, and with all herons and egrets, they are a light chalky to greenish-blue.

Every inducement should be offered to herons to encourage them to breed in the Colony, for the value of these birds is inestimable. The best means would be by planting suitable groves of trees alongside dams and rivers, and especially on islands. As yet, there are no records of the breeding by any of the larger or more important herons in this country, though they do so plentifully both to the south and north. It might be that our information is still too scanty, and that local heronries have not yet come to the notice of ornithologists. Herons breed in favoured places in the Transvaal bushveld, in Bechuanaland, and in Barotseland and the Kafue Flats in Northern Rhodesia. There is thus every possibility that they will extend their breeding range to this country as well.

Rather similar to the Black-necked Heron is the Grey Heron (*Ardea cinerea*). This bird has a very wide distribution, being found throughout most of Africa, as well as Europe and portions of Asia. It has a whitish neck, in contrast to the black of its near relative, and has a black stripe just above the eyes, terminating in a few longish plumes at the back of the head.

This bird is far more dependent on water than the Black-necked, and in consequence, is very seldom seen in Matabeleland.

It probably takes as wide a variety of food as does its cousin, but fish and water animals play a larger role in its diet. Except at breeding time, it is a solitary bird, to be seen standing motionless in the shallows of a vlei, with the neck drawn up into the typical "S" pattern of all herons.

Taller than either of the two preceding birds, is the Goliath Heron (*Ardea goliath*). It has a grey back, with chestnut-red neck and belly, and stands nearly five feet high. Although it has a very wide distribution, it is in all places a scarce bird, more than a pair being seldom seen on the same stretch of water.

Purple Herons (*Ardea purpurea*) are very occasionally met with in Rhodesia, being, like the others, much more common to the north and south. It is typically a bird of vleis where it hides in the grass and sedges, in wait of frogs and probably, also, water-rats.

The next three birds are all rather similar, being plain white, but may be distinguished by the colours of their legs and bills, as well as by size, though this is liable to be deceptive. These three birds are the Great White Heron (*Casmerodius albus melanorhyncus*), the Yellow-billed Egret (*Egretta intermedia brachyrhyncha*), and the Little Egret (*Egretta garzetta*). The first is exclusively a water bird, and while the other two do occasionally wander in the veld in company with Cattle Egrets, they are most commonly found in the vicinity of streams and vleis. All three are very scarce in this country.

The only member of the family which is to be found in any numbers here is the Cattle Egret (*Bubulcus ibis*). This is the common white bird found in small flocks following cattle in the veld. It occurs as far north as Spain, but is a typical sight in most of the more open veld of Africa. In the north, it follows game in the absence of cattle; insects disturbed from the grass by the animals are its chief source of food, but it will also take insects from off the animals themselves. It is thought that the insects pecked off the animals are mainly ticks, but as yet no-one seems to have done any detailed stomach analyses of this species.

A few people have suggested that Cattle Egrets may be the vectors or disseminators of certain stock diseases, and while this is not impossible, it is very improbable, as the birds seldom are in actual contact with the animals; an occasional brief peck at an insect is hardly likely to transmit an infection from one beast to another.

Virtually all authorities are in agreement that the Cattle Egret is one of the most useful, as well as ornamental, birds which we have, and everywhere it is accorded full protection. A flock of these dazzling white birds following a herd of cattle through the veld, or else winging their way homewards, in perfect "V" formation, is indeed a lovely sight.

The breeding habits of the Rhodesian birds are still a complete mystery. In South Africa, these birds breed in mid-summer, which is when Cattle Egrets are at their commonest in Rhodesia. They are to be found here throughout the year, though disappearing from Matabeleland in winter. They are in breeding plumage

in summer, yet it would appear that it is in winter that they retire from here to breed. In Northern Rhodesia, they breed from February to June, and it would be interesting to know if our birds move that far for this purpose. There is no doubt that they are migratory to some extent, and it is hoped that ringing of the birds will eventually throw some light on this subject.

Similar in size to the Cattle Egret, is the Black Heron (*Melanophoyx ardesiaca*). As the name indicates, it is completely black, but with a greyish bloom to the feathers. It has a habit, unique among birds, of shading the water with its wings, in order to eliminate surface reflection. As it stalks along through the shallows, it throws its wings forward to form a complete umbrella over its head, from beneath which it peers into the water in search of tadpoles or fish. Though nowhere common, this bird seems to be on the increase in Southern Africa, but as yet has not been known to breed here.

The last two herons worth mentioning are the Green-backed (*Butorides striatus atricapillus*), and the Night Heron (*Nycticorax nycticorax*). The former is a small solitary bird, to be found on most Rhodesian streams perched in the lower branches of a small tree or bush over the water. Little seems to be known of its diet, though this probably consists of snails and other small water-animals.

The Night Heron is a rather striking bird, with greeny-black back and whitish underparts, and a long white plume from behind each ear. It is nocturnal for the greater part, spending the day sitting motionless in a leafy tree over water. It breeds in company with Cattle Egrets and Herons in the Union, but there appear to be no records from Rhodesia.

In all, the Herons and Egrets have a very favourable balance sheet to their credit, and deserve every protection. It is to be hoped that with the increasing numbers of dams being built, and with larger areas being cleared of bush, that these birds will in future be a more abundant feature of our veld than hitherto.

Cattle Egrets drinking at sunset.

Black-necked Heron. The commonest of the larger herons.

Some Notes on the Properties of Vermiculite in relation to its use in Agriculture and Horticulture

By D. H. SAUNDER, M.Sc., Ph.D.,
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INTRODUCTION.

In Rhodesia exfoliated vermiculite is being used for agricultural and horticultural purposes, but little or no experimental data is available as to its value in this connection. It is hoped that the present paper will help to remedy this deficiency and lead to a better understanding of those properties of vermiculite that are of importance for various purposes.

Determinations have been made of the amount of water that can be retained by vermiculite at saturation, at field capacity, and at the wilting point; for comparison similar determinations were made on three widely different soils. Evaporation rates, temperatures and pH values were also determined.

In the light of these results a discussion of the agricultural and horticultural use of vermiculite is given.

EXPERIMENTAL.

The samples of exfoliated vermiculite for this work were kindly donated by Central African Base Metals, Ltd., and by the Sabi Vermiculite Company.

The soils used for comparison were:—

(1) A red clay of the Salisbury series, derived from dolerite, and having a total nitrogen content of 0.16%;

(2) A very light grey coarse sand typical of the granite sandveld areas (total nitrogen 0.04%);

(3) A black sandy loam from a granite sandveld vlei and containing a relatively high proportion of organic matter (total nitrogen 0.40%).

In all cases the water contents have been expressed on a volume basis. It is the amount of water available in a given volume that is the important factor in plant growth. Results expressed on a weight basis for materials of such widely varying densities as soil and vermiculite would not be comparable. The actual determinations were made gravimetrically and converted to a volume basis using determined density values. It must be emphasised that these figures should be regarded as being only approximations to the actual results which might obtain in practice. This is due mainly to the fairly considerable differences that can be obtained in the density figures by varying the compaction of the soil or vermiculite, and also to the fact that a certain amount of expansion occurs during wetting.

The following techniques were employed:—

Density.—The apparent densities of the air dry materials were determined by weighing against an equal volume of water, each sample being packed only under its own weight.

Maximum Water Holding Capacity.—The maximum amount of water that could be retained by a 1 to 2 inch layer of the sample on a fine meshed sieve against gravity was determined. This method was simple and quick and proved to give good agreement with standard methods employing the Keen Raczkowski box.

Field Capacity and Wilting Point.—The method used was similar to that employed at Rothamstead (Russell and Balcerek, Journal of Agricultural Science, Vol. 34, p. 130).

For the field capacity the samples were equilibriated at a suction of 20 inches of water (representing a pF of 1.7). This should give a fair approximation to the actual suction which is experienced in the field under average conditions of free drainage.

For the wilting point the samples were equilibriated in an atmosphere of relative humidity 98.5% (representing a pF of 4.2). The figures obtained were confirmed by actual wilting trials with maize plants. The plants were found to wilt permanently when the moisture content was, within experimental errors, the same as that obtained at pF 4.2.

The term pF is one used by soil psysicists to indicate the force with which water is retained in a soil. It represents the logarithm of the suction (in inches of water) against which the soil can retain a particular amount of water.

pH. 1:5 suspensions in distilled water were used and a glass electrode employed.

RESULTS.

Water Holding Capacities and Wilting Points.

The results obtained for these are shown in Table I.

TABLE I.

Sample	Apparent Density	Maximum Water held against gravity at saturation % Moisture by Volume	Field Capacity (at pF 1.7) % Moisture by Volume	Wilting Point (at pF 4.2) % Moisture by Volume
Salisbury red clay	1.2	60	35	12
Coarse light-grey granite sand	1.5	33	16	1.9
Black sandy loam from sandveld vlei	0.9	68	29	13
Exfoliated Vermiculite (Dust	0.38*	72*	—	—
Exfoliated Vermiculite (Fine grade (1/8-1/16" mesh)	0.27*	68*	19	1.8
Exfoliated Vermiculite (Medium grade (1/4-1/8" mesh)	0.25*	64*	—	—

* These figures are mean values for several different samples.

Vermiculite shows a very wide discrepancy between its water contents at saturation and at field capacity, much wider than is the case for soils. This is to be anticipated since exfoliated vermiculite has a very high pore space and so can accommodate a large amount of water at saturation; these pores are however comparatively large, and so cannot retentively hold water against suction such as would be experienced in the field under conditions of free drainage. Since water is easily withdrawn the wilting point is low.

The pore spaces in the sand being also comparatively large, it has a low field capacity and wilting point similar to that of vermiculite. The total pore space in the sand is however very much less, so that the water content at saturation is also less.

The much finer pore spaces in the clay and in the sandy loam of high humus content enable them to retain more water against suction; thus both the field capacities and wilting points are higher.

Water Available to Plants and Relative Rates of Evaporation.

Samples of soil and vermiculite were raised to saturation and then allowed to dry out under similar conditions for four days. The results are shown in Table II.

TABLE II.

Sample	Water available to plants held at saturation (Saturation Capacity —Wilting Point) % by Volume	Water lost by evaporation in four days % by Volume	% of water that is available lost in four days
Salisbury red clay	48	40	83
Coarse light-grey granite sand	31	29	94
Black sandy loam from sandveld vlei	55	31	56
Exfoliated vermiculite (fine)	66	30	45

In general there is not a very great difference in the absolute rates at which water is lost from these soils and from vermiculite. There is however a considerable difference in the amount of water initially present that is available to plants, so that plants should survive for much longer in vermiculite than in the clay or sand and for somewhat longer than in the sandy loam of high humus content. This is shown in the last column of Table II, and was confirmed by pot experiments with maize. When the plants had reached about nine inches in height the pots were well saturated and then allowed to dry out in a greenhouse. It was found that the maize in Salisbury red clay wilted after about six days whilst that in vermiculite wilted after about twenty days.

It should be emphasised that these results apply only when the soil or vermiculite can be raised to saturation capacity, as in seed tins or boxes where there is no suction from adjacent drier soil or from drainage through the soil profile.

In the field where free drainage exists it is not possible to raise the soil above field capacity; there is then no great difference between the water available to plants that can be held by soils and by vermiculite. This is shown in Table III.

TABLE III.

Sample	Water available to plants under field conditions (Field Capacity—Wilting Point) % by volume
Salisbury red clay	23
Coarse light-grey granite sand	14
Black sandy loam from sandveld vlei	16
Exfoliated vermiculite (fine)	17

The relative rates of evaporation obtained for these soils and vermiculite in the experiment mentioned will not necessarily hold under field conditions where so many other factors are of importance. It is obvious, however, from the similarity in the amounts of available water that can be held under field conditions by these soils and by vermiculite, that the relative field evaporation rates would have to differ widely from those observed in the above experiment for there to be any appreciable improvement in moisture status resulting from the use of vermiculite in the field.

pH Values.

Different samples of vermiculite may have somewhat different reactions. It has been found in general that:—

Vermiculite from Winterstale has a pH of from 6—7, while

Vermiculite from the Sabi has a pH of from 8—9.5.

Unlike soils, a high pH in vermiculite does not necessarily indicate any accumulation of salts. Vermiculite is an inert material and, as it is not buffered by the presence of soluble salts, only very small traces of soluble basic minerals are necessary to raise the pH to quite a high value. Such traces need not be harmful to plant growth.

If vermiculite is mixed with soil, then, in anything up to high concentrations of vermiculite, the pH of the vermiculite is of little significance in its effect on the pH of the mixture. This is due to the comparatively high buffering action of the soil, and is illustrated in Table IV by a series of pH determinations that were made on mixtures of Salisbury red clay (pH 6.1) with an alkaline sample of vermiculite (pH 8.9).

TABLE IV.

% Vermiculite	% Red Clay	pH of Mixture
0	100	6.1
15	85	6.3
35	65	6.5
65	35	6.7
85	15	7.0
100	0	8.9

Temperatures.

Samples of soil and vermiculite were placed in fairly large pots and raised to field capacity by watering with the calculated quantity of water in the early morning. They were then placed in a position sheltered from wind but exposed to the full rays of the sun on a hot September day. At 2.30 p.m. temperatures were taken and were as shown in Table V.

TABLE V.

Sample	Temperatures at 2.30 p.m.	
	Surface Temperature °F	Temperature at a depth of 4-5 inches °F
Salisbury red clay	100	88
Coarse light-grey granite sand	91	90
Black sandy loam from sandveld vlei	109	97
Exfoliated vermiculite (medium)	91	73

The surface temperatures depend largely on the colour of the material. Thus the black soil which will absorb most heat shows the highest temperature; the red soil is intermediate between the black soil and the light coloured sand and vermiculite.

The temperatures at a depth of four to five inches are of more importance as far as the root zone of small plants is concerned. At this depth the vermiculite remains cooler than either the red clay or coarse sand which are in turn cooler than the black vlei soil. It has been stated that the optimum temperature for nitrification in soils lies between 80 and 90°F; but, in the absence of data as to the ideal growing temperature for plants, it is difficult to interpret the above results. It should be remembered that the conditions of this experiment were more severe than is likely to occur in the field, particularly in seed beds: the samples were completely sheltered from wind and were exposed to full strong sunshine throughout the heat of the day without receiving any additional watering. On the whole, it is perhaps doubtful whether the use of vermiculite in order to maintain lower temperatures is of real value even in summer, whereas it is probably an actual disadvantage in winter.

SOME NOTES OF THE AGRICULTURAL USES OF VERMICULITE.

As a cultural medium for plant growth vermiculite offers a very open textured material which permits rapid and easy root penetration and allows good aeration. Being an inert material it does not supply any plant foods and cannot offer any means for the retention of added nutrient elements, as is supplied by the clay complex in a soil.

Vermiculite may thus be used for any of the horticultural purposes to which washed sand was formerly put, such as the striking of cuttings and hydroponics. The finer meshed grades of vermiculite should be the best for this purpose. The advantage of vermiculite over sand is that at saturation it has a much higher water holding capacity, whilst it has an equally low wilting point.

If pure vermiculite is to be used in this way it is perhaps advisable to select a sample of vermiculite which has a pH value falling within the generally accepted range for plant growth. In this connection, however, it is worth noting that the author has raised plants from seedlings to maturity using a sample of vermiculite of pH 9.3.

Vermiculite has also been advocated as a soil ameliorant when preparing seed beds and tins and for various other cultural uses. For this purpose the pH of the vermiculite is of little significance. When discussing these uses of vermiculite it is necessary that they should be considered in two distinct categories. Firstly there is the use of vermiculite in situations where it is possible to raise the material to a moisture content approaching saturation; this applies to seed boxes, tins and pots. Secondly, there is the use of vermiculite in the field and in beds in well drained localities where it is not possible to raise the moisture content above field capacity.

The Use of Vermiculite in Seed Boxes, Tins and Pots.

Reference to Tables I and II will show that vermiculite when saturated with water will retain 66% by volume of water available to plants, as compared with 55% for the black sandy loam of high humus content, 48% for the red clay, and 31% for the granite sand. On the score of moisture holding capacity alone, therefore, vermiculite offers a big advantage over soil. A further advantage is the open textured nature of the material which allows of vigorous root development.

If pure vermiculite is used there is the disadvantage that plant foods must be continuously supplied. It would therefore be best to use a mixture of vermiculite (a fairly fine meshed grade is probably best) with a good soil containing a fair proportion of clay. It is suggested that a 50/50 mixture should be suitable.

The Use of Vermiculite in Seed Beds or in the Field Generally.

Reference to Tables I and III will show that there is no great difference between the amounts of water available to plants that can be held by soils and by vermiculite at field capacity, under

conditions of good drainage. Unless the use of vermiculite very significantly decreases the evaporation rate in the field (evidence for which is not available) there would appear to be little advantage to be gained from its use on the score of improving the moisture status of the soil.

In general, where moisture has to be conserved, the use of a mulch is undoubtedly the most efficient method. This does not of course improve the water-holding capacity of the soil, but it does reduce evaporation losses. A coarse grade of vermiculite would be very suitable for this and would have the advantage of being sterile and less likely to harbour pests; but its use in this way would prove expensive.

The use of vermiculite in heavy soils would undoubtedly produce an improvement in texture; but superior, though temporary, textural improvements can be achieved with the use of less expensive aerating materials such as manure and garden refuse.

The use of vermiculite in sandy soils would not appear to offer any advantages over the use of organic matter or of richer heavier soils, whereas these latter have the advantage of improving fertility.

When used for filling holes during transplanting, vermiculite has the advantage that it may be transported in a moist, saturated condition without danger of puddling. It can be thus used as a convenient vehicle for supplying extra moisture to transplants where they cannot be watered. This vermiculite will not, however, bring about any improvement in the capacity of the land for retaining moisture.

Tsetse Fly in S. Rhodesia, 1949

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Before detailing the work carried out against Tsetse during 1949, a short explanatory introduction is included so that those who do not follow this work from year to year may be better able to appreciate the position.

The Tsetse Fly is well known as one of man's worst enemies over the greater part of Africa south of the Sahara. What is not so generally realised is that there are about twenty different species of Tsetse Fly (genus *Glossina*) occurring in the continent.

The significance of the Tsetse to man lies in the fact that most, if not all, of the species are capable of bringing and spreading trypanosomiasis among man and his domestic animals. The most important African forms of this disease are known as sleeping sickness in man, and nagana in cattle.

The different species of Tsetse are all of rather similar appearance, and they are further alike in that they all feed exclusively on the blood of vertebrate animals. They differ widely, however, in their preferences for different vertebrates as a source of food, reptiles, birds, game animals, man, and even carnivores being all attacked in varying degree by different species. Furthermore, although several species of Tsetse may sometimes be established in one area, no two species of Tsetse have exactly the same ecological requirements. Thus it will be apparent that a method of control used successfully against any one species of Tsetse in a particular locality may be quite ineffective against another species of Tsetse, or even against the same species in a different locality. So far no practical method of control has been discovered which is effective against all species in all localities.

In Southern Rhodesia three species of Tsetse, *G. morsitans*, Westw., *G. pallidipes*, Aust., and *G. brevipalpis*, Newst., occur. *G. morsitans* is widespread in the northern part of the Colony, in and adjoining the Zambesi Valley, and is found again just across the South-Eastern border of the Colony. The other two species are found only along a small part of the South-Eastern border of the Colony near Mount Silinda, except for a small area in the Sebungwe and Wankie Districts, in which *G. pallidipes* occurs. The present distribution of the three species is shown on the accompanying map. Two other areas of distribution are also shown. The first is of historical interest and shows the distribution of *G. morsitans* in the mid nineteenth century, having been deduced from the writings of various early travellers. This area is important in so far as it shows how much of the Colony might be overrun by this Tsetse were active steps for its control not taken. At the end of the last century Tsetse disappeared from the previously infasted southern part of the Colony and almost completely from the northern part, remaining only in a few small isolated "residual foci." This was mainly due to the fact that, in 1896,

an outbreak of rinderpest swept through the Colony, killing off a large proportion of the game and thus greatly reducing the food available for Tsetse. From these residual foci Tsetse began to spread and were in process of re-occupying their former natural haunts. In 1919 game reduction operations were introduced, experimentally at first, and the spread was checked by about 1930. By this time the area shown north of the broken line on the map had been re-occupied by them. The stippled area between this boundary and the boundary of present distribution represents the amount of land, about 10,000 square miles, reclaimed by Tsetse Fly Operations. It must also be borne in mind that, had these operations not been initiated, a considerable part, if not all, of the area between the nineteenth century and 1930 boundaries, would probably have been re-occupied.

For the control of *G. morsitans* in Southern Rhodesia, controlled discriminate game destruction has been carried out since 1925. By this method the larger game animals, on which alone *G. morsitans* can thrive, are so reduced in numbers in a belt (usually about twenty miles wide) along the boundary of infestation that the Tsetse can no longer survive, because it is unable to obtain meals with sufficient dependability and regularity. Thus the fly, in effect, retreats. The barrier belt is then pushed forward by about half its depth, and the Tsetse is driven in turn from this new belt. This process can be repeated.

A fundamental feature of this type of control is that no attempt is made to reclaim land unless the land is required for settlement and development. There are two main reasons for this. One is that it is desired to keep the number of game animals necessarily destroyed as low as possible. The other reason is that sufficiently close settlement of land, if the land can continue to support such settlement, is, of itself, an excellent barrier to the renewed spread of Tsetse. The present position is that the barrier belts have been kept stationary since 1940 and are used to prevent a renewed advance of fly into country already reclaimed.

Since *G. brevipalpis* and *G. pallidipes* can thrive on other than the larger game animals, it follows that the method of game destruction cannot in practice be applied to the control of these two species of Tsetse. Fortunately, these species, the forest and thicket flies, are more dependent on shade for survival than is *G. morsitans*. Therefore a barrier clearing about 40 miles long and on the average about one mile wide has been constructed and maintained along the Eastern border of the Colony, part of the clearing being in Portuguese territory. These two species are present in high density on the Portuguese side of the clearing, as is *G. morsitans* along part of its length, but they seldom, if ever, succeed in crossing the barrier clearing. Since the clearing was widened to its present width no Tsetse have been seen west of it. That Tsetse may sometimes cross it is surmised from the occasional limited outbreaks of animal trypanosomiasis occurring on the Rhodesian side. There are, however, other possible explanations for these outbreaks. To counter them the cattle are subject to strict veterinary supervision under the direction of

the Director of Veterinary Services, so that deaths from nagana seldom occur in this area now.

Game sanctuaries in the neighbourhood of Tsetse Fly Areas remain as in 1948. The Wankie Game Reserve has, however, now been constituted a National Park. As last year, it remains free from the threat of Tsetse Fly. The area between the Angwa and Rekomitje Rivers North of the Zambesi Escarpment is still closed to all shooting, and the game there remains unmolested.

The results of the year's work are particularly difficult to assess owing to the prolonged and severe dry season. In several areas pools and waterholes which had been regarded as permanent dried up for the first time in the memory of the local inhabitants. This led to game ranging more widely than is usual, and it is surmised that this explained the capture of occasional flies outside the areas to which our operations normally confine them. Support for this hypothesis is forthcoming from the numbers of Tsetse caught by traffic on the Sinoia-Chirundu road. These increased enormously during the dry season and in some months the totals were higher than had ever previously been recorded since the commencement of these observations. With the advent of the rains, the numbers fell to normal in November. The increase here was associated particularly with the abundance and wide ranging of elephants. In other affected areas, namely Sebungwe, Urungwe, and Zambesi Valley (Hunyani), these animals, and also buffalo, were noted as being numerous and much given to wandering. Because of this obscuring feature it is not possible to say that in any area the position has materially improved during the year. Nevertheless there are no indications that any permanent advance of fly has occurred in any area, and there has been no advance into reclaimed ground outside our hunting areas.

It is also possible that a cyclical increase of *G. morsitans* is beginning. Such behaviour has been suggested elsewhere with other species of *Glossina*. Observations in subsequent years should show whether this is so. In the Hartley District again no Tsetse have been caught east of the Umniati River. A report of two flies said to have been caught on the Gadza River was painstakingly investigated and, in the absence of any confirmatory evidence, is considered to be false. Development of the Sanyati Native Reserve continues, there being an estimated population now of 729 natives who own 535 head of cattle. There were no cases of trypanosomiasis either in these or in any other cattle in the Hartley District.

The measures instituted in 1948 in the Mtoko District for the control of the animal trypanosomiasis outbreaks in the Mkota and Chikwizo Reserves, namely the shooting of a limited number of elephant and inoculation of cattle with dimidium bromide, were continued in 1949. The Portuguese authorities have co-operated by shooting game on their side of the border and erecting a fly-chamber on the main Border-Changara road. The incidence of animal trypanosomiasis in the area has been less than in 1948.

In the Chipinga area the number of reported cases of animal trypanosomiasis was rather less than in 1948. The only outbreak of abnormal proportions occurred on the farm, Mount Silinda, and

was probably due to cattle straying across the clearing into the heavily infested Tsetse bush on the Portuguese side of the clearing.

In all other areas the position shows very little change since 1948.

Cases of human trypanosomiasis, or sleeping sickness, in Southern Rhodesia numbered three as against nine in 1948. One case was fatal, and this case probably contracted the disease in Southern Rhodesia.

The length of road wholly or partly constructed and maintained by Tsetse Fly Operations or through its vote is approximately 500 miles.

Some further information on the drug, Antrycide, came to light during the year. The drug has not been used at all in this Colony because of one disturbing feature. It was discovered elsewhere that in some cases resistant strains of trypanosomes (the causative organisms of trypanosomiasis) were built up following the use of Antrycide. These strains were discovered to be resistant, not only to Antrycide, but also to dimidium bromide (which is perhaps better known as Phenanthredinium 1553), which has been in use for some years by the Veterinary Department as an effective curative drug for animal trypanosomiasis in this Colony. There was thus the risk that, were Antrycide used, any initial advantage gained might later on be completely outweighed by the development of these resistant strains, leaving Antrycide and our other most satisfactory curative drug, dimidium bromide, comparatively useless. It was felt that circumstances did not justify this risk, and the use of Antrycide has therefore been deferred until more is known about this aspect.

Conferences and Committees.

The first meeting of the International Scientific Committee for Tsetse and Trypanosomiasis Research was held in London from February 8th to 11th, 1949. Southern Rhodesia was represented by Dr. G. R. Ross, Director of Curative Services, and Mr. J. K. Chorley, Director of Research and Specialist Services. Mr. D. A. Lawrence, Assistant Director of Veterinary Services (Research), attended as veterinary observer and adviser. Matters connected with trypanosomiasis (affecting many African territories), and particularly the drug Antrycide, were discussed at the conference.

The conference was fully reported to the Southern Rhodesia Trypanosomiasis Committee by the delegates on their return.

The Bureau Permanent Interafricain de la Tsétsé et de la Trypanosome was established at Leopoldville during the year, and much useful information received from it circulated among the members of the Southern Rhodesia Trypanosomiasis Committee.

Two full meetings of the Southern Rhodesia Trypanosomiasis Committee and one special sub-committee meeting were attended. The discussions of this Committee included:—

1. The trypanosomiasis position in the Mtoko District resulting from the fly belt in neighbouring Portuguese territory.

2. The information obtained by the Southern Rhodesian representatives at the first meeting of the International Scientific Committee for Tsetse and Trypanosomiasis Research.

3. The award of scholarships by the Beit Railway Trust for Tsetse Research and attendant conditions.

4. The latest information received in connection with the Zululand DDT experiments for the control of Tsetse.

5. The outbreak of animal trypanosomiasis at Mount Silinda.

6. Participation in the work of the Tsetse Fly and Trypanosomiasis Permanent Inter-African Bureau at Leopoldville.

7. The expressed views of the Wild Life Protection Society of Rhodesia in regard to the present method of Tsetse Control.

8. Several minor matters.

Destruction of Game.

The number of head of game destroyed increased from 22,160 in 1948 to 24,871 in 1949. This increase is due partly to the intensification of shooting which took place in the Sebungwe District and partly to the reintroduction of shooting duiker there.

The award of 2s. 6d. placed on the head of a baboon since its classification as vermin seems to have had no effect on the numbers destroyed on Tsetse Fly Operations (1,884 compared with 2,079 in 1948). This is attributed to the fact that the hunters utilise all the edible meat of the game which they shoot, and are naturally inclined to satisfy their appetites before expending their limited ammunition on baboons. A reward of 2s. 6d. for a baboon would be likely to alter the position only if they otherwise destroyed more edible game than they could utilise.

During the year an average of 2.29 rounds of ammunition per head of game destroyed was used. The number of each species destroyed was as follows:—

Elephant	42	Reedbuck	663
Rhinoceros	3	Bushbuck	1,841
Buffalo	393	Duiker	6,749
Zebra	226	Warthog	3,629
Eland	254	Bush Pig	813
Kudu	3,953	Baboon	1,884
Roan	268	Lion	7
Sable	1,005	Leopard	16
Waterbuck	479	Cheetah	1
Hartebeest	39	Hyaena	9
Tsessebe	104	Wild Dog	15
Impala	2,477	Jackal	1
	Total	24,871	

SHORT SURVEY OF THE TSETSE FLY OPERATIONS BY DISTRICTS.

Darwin.

There is no significant change to report from this area. Fly, *G. morsitans*, occupies the same ground as last year, but is in very low density over most of the infested area except on the Portuguese border. There has been no evidence of any tendency of fly to spread and no fly have been seen above the escarpment in this area.

No accurate figures for the number of cattle in the area are available, but it is known that there are over 100 head in the region of Kaitano's kraal. No cases of trypanosomiasis have occurred in the area.

Zambesi Valley (Hunyani).

This area has been renamed, since Lomagundi (Doma), the site of the Ranger's old camp, is now well behind the present line of Tsetse Fly Operations.

There is little to report from the area. No fly were seen above the escarpment, but *G. morsitans* persists in the valley. This area was one of those most affected by the drought, with consequent wide ranging of game, particularly noticeable in the case of elephant and buffalo. This led to a temporary increase in fly near the escarpment on the Angwa River, where practically the only surface water, other than the Hunyani River, in the area was located, at the end of the dry season. No corresponding increase on the Hunyani River, where Tsetse now occur only sparingly below the Ranger's camp was noticed. Elsewhere in the area fly is thinly distributed, becoming more numerous on the Hunyani close to the Portuguese border, but beyond the area of present operations.

There are 21 head of cattle at the Msengedzi Mission and no cases of trypanosomiasis have been reported from this area.

Urungwe.

The effects of the drought were perhaps more marked in this area than in any other, and game wandered for great distances in search of water. Some sources of water which dried up were stated by the local natives never to have done so before. Consequently, as was to be expected, a few Tsetse were found outside their normal area of distribution, including one on the Mtshowe River in the south-west of the area. With the onset of the rains in November, the position, as far as could be judged, appeared rapidly to return to normal. *G. morsitans* remains fairly dense at all places in the area below the Zambesi escarpment, and is present in varying densities along the Sanyati River and its tributaries as far south as the Tengwe River. At Chipisa Spring, where fly used to very dense, it has now almost completely disappeared. This is a result of heavy settlement connected with mining activity having destroyed or driven away all the game. It is seldom now that any game is seen here. This activity may not be permanent, and if it is not it will probably be difficult to maintain the position.

The amount of traffic up and down the escarpment, particularly foot but including also vehicles, increased greatly and accordingly a barrier was erected with a fly picket at the Midway Mine. The Native Department co-operated fully and compelled all natives to pass through the barrier instead of using any of several foot-paths in the area. Such uncontrolled traffic would otherwise permit Tsetse to be brought up the escarpment. The erection of the barrier was fully justified as can be seen from the numbers of Tsetse caught, shown in the Traffic Control section of this report.

The number of cattle present in the Urungwe Native Reserve increased during the year to 7,528. No cases of animal trypanosomiasis were reported anywhere in the area.

Chirundu.

As with the Urungwe Area this area was markedly affected by drought. Elephant became particularly numerous, wandered a great deal, and were often seen close to the main Chirundu Bridge road. As they are not shot in this area they are probably largely responsible for the very marked increase in the numbers of Tsetse (*G. morsitans*) caught at all traffic control points in the latter part of the dry season. Although the total numbers of Tsetse caught in the year at each of these points (see Traffic Control section) are much higher than in recent years, a deterioration in the position is not necessarily indicated. During the early months of the year, and again in November and December after the rains had started, the numbers were normal for recent years. The increased totals are made up entirely by the greatly increased numbers caught in the latter part of the dry season.

Shooting in the area has again been confined to a belt five miles wide on each side of the main road between the escarpment and Chirundu Bridge. No effort is being made to exterminate Tsetse in the area. Any such effort would necessitate extending the operations over a much larger area without the prospect of holding the land so gained by settlement and development. The present operations aim only at reducing the density of game and Tsetse along the main road, so as to reduce the numbers of Tsetse being transported by traffic along the road.

Lomagundi S.W.

The position in this area remains much the same as last year. No evidence of any renewed spread of fly has been found, and again no fly has been seen west of the Umniati and Sanyati Rivers south of the Mtshowe River, which is the northern boundary of this area. In view of the occurrence of *G. pallidipes* further west in the Sebungwe District a careful watch for this species has been kept, including reconnaissances into the Sebungwe Native Reserve beyond the present area of operations. No evidence of the occurrence of this species has so far been found. As it is a species which, if present in small numbers, may be difficult to detect, the search for it will continue.

The nearest cattle to the fly belt in this area are at Hova's, about 10 miles east of Sanyati Junction. They have remained in good condition throughout the year. No cases of animal trypanosomiasis have been reported anywhere in the area.

Hartley.

Again no Tsetse have been seen in the Hartley District despite thorough search. Reports of their presence have been made by native hunters in the Ruswingo Vlei area. As native hunters are usually expert at catching Tsetses, the absence of specimens discredits these reports. Two Tsetse were produced purporting to be from the Gadza River. The report was fully investigated and the area thoroughly but unsuccessfully searched for more, and it is concluded that the flies were brought from some other area. The reasons prompting natives to make these false reports are quite simple. They know that when an area is cleared of fly it is possible that the line of shooting might be advanced, and they do not wish to give up their rifles and thus lose their supply of meat; nor are they willing to leave their present habitations to follow the fly.

The position west of the Umniati River in the Sebungwe District remains the same as last year, no evidence of any advance of Tsetse having come to light.

The native population of the Sanyati Reserve has now risen to 729 and the number of cattle to 535, besides goats and donkeys. No case of animal trypanosomiasis has been reported anywhere in the area.

Sebungwe.

The general fly position remained unchanged. On the Nagupande, Chebira, Malindi and Sengwa Rivers, *G. morsitans* is still found in moderate numbers. South of these localities only very occasional Tsetse are found, and most of these have been in situations such as make the possibility of their having been carried a real one. A careful search in December failed to detect Tsetse on the Golongola River, but it is too early yet to say that they have finally disappeared from this river. Again no Tsetse were found on the Mzola River or anywhere else south of the Mkulugusi belt. In this District also there was very marked game movement due to the drought, resulting in a, probably temporary, scattering of *G. morsitans* towards the end of the dry season. A total of six specimens of this Tsetse were caught on the Bemsee, Kawindi, Sipoli and Kanyandavu Rivers, which lie south of the main area of distribution, in October. At this time game also concentrated on the Mzola River, but despite a thorough search no Tsetse were found in their vicinity.

The occurrence of *G. pallidipes* at Chenga on the Nagupande River, discovered in 1942, was verified in December. *G. pallidipes* is also known to be present near the junction of the Sebungwe and Maseme Rivers, north of the area of present operation.

The destruction of game has been intensified during the year by increasing the number of hunters, in an effort more rapidly to render the area north of the Mzola River safe for cattle. The effects of this intensification are not yet apparent, possibly because of the abnormal dry season and also probably because this intensification has not yet been in operation for a long enough period to have any visible effect.

A second Ranger has been appointed and is established at the Sengwa Gorge to supervise operations in the eastern part of the area, which had perforce been to some extent neglected because of the size of the area.

A picket has been established at the Nagupande Drift on the main road from the Ranger's camp at Lusulu to Gwaai Bridge. This has been necessitated by an increase in the amount of traffic on this road. Otherwise the danger of transporting Tsetse from the area north of the Nagupande River to the cattle on the Karna Block or even further afield would be considerable.

Blood smears were taken from all 27 of the cattle at Pashu's Kraal in February. Six of these showed the presence of trypanosomes. The cattle appear to be resistant animals as no deaths were reported during the year. The animals suffered from drought, however, and in December smears were taken from 11 of the worst looking animals. None of these showed the presence of trypanosomes. Other than these cattle in the west, there are now present in the Sebungwe District 8,345 head of cattle compared with 7,416 head in 1948. No cases of trypanosomiasis occurred in any of these cattle though, as in 1948 some of them are close to the present Tsetse Fly limit. There was no suspicion of trypanosomiasis in any of the cattle on the south bank of the Kana River, (Shangani District), reclaimed country immediately to the south of our present operations.

Mtoko.

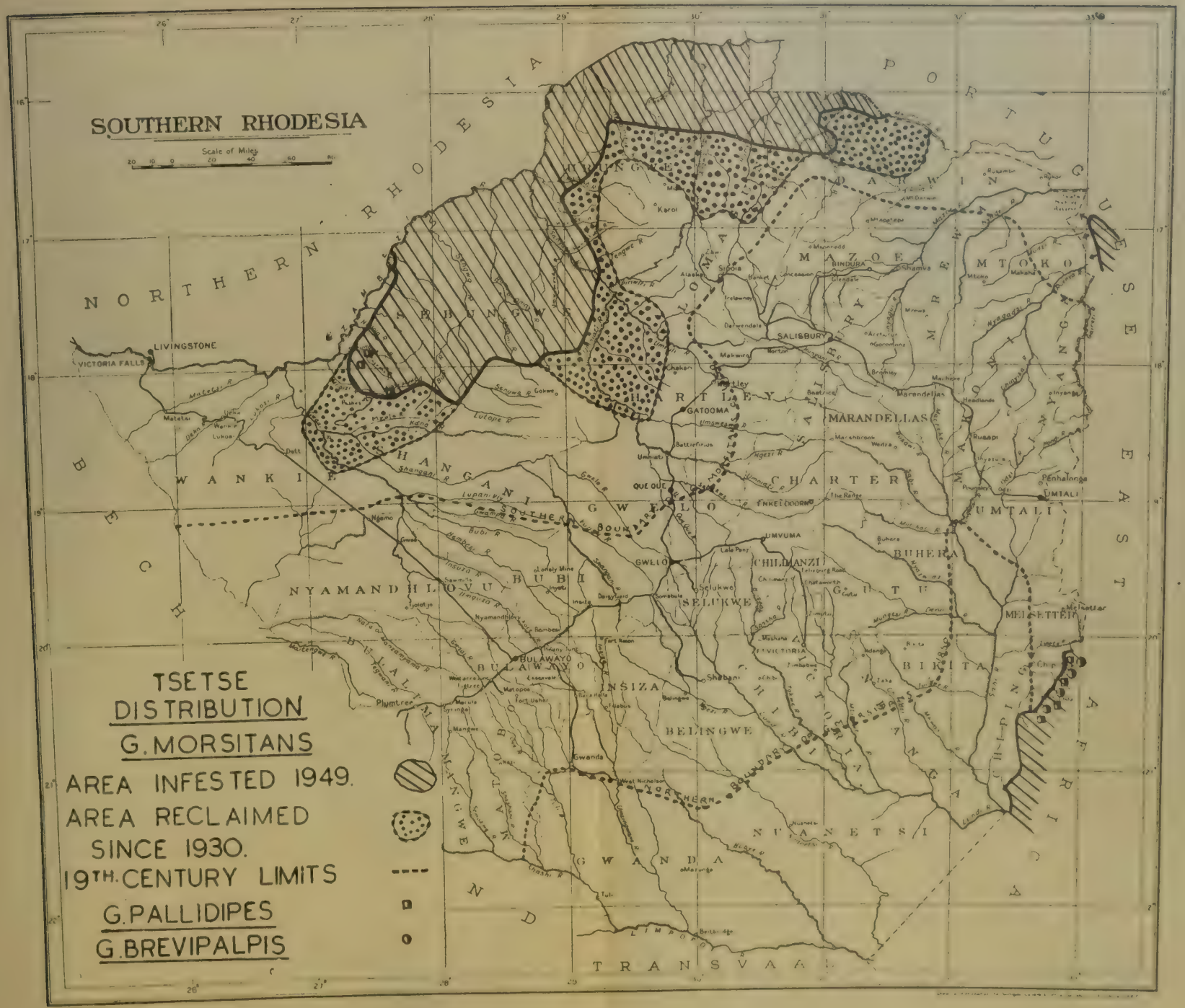
No major outbreak of animal trypanosomiasis corresponding to that occurring in 1948 was reported during 1949 in the Mkota Reserve. Twenty-one deaths definitely attributable to trypanosomiasis occurred, compared with over 100 in 1948. Treatment of infected kraals with dimidium bromide continued and a number of cattle known to have trypanosomiasis recovered as a result. Blood smears were examined by the Veterinary Research Laboratory from 10 per cent. of the animals in the Reserve and trypanosomiasis was found to be present in 19 of 84 kraals, representing an infection of probably less than 1 per cent. of the total cattle in the Reserve.

The control of elephant in the area continued, and 30 were destroyed during the year.

Early in the year an experienced native was stationed close to the border for about a month. He examined traffic coming from Portuguese East Africa, and also travelled on the Uleri lorries using the Border-Changara road to see if he could find any evidence of the transport of Tsetse into Southern Rhodesia by traffic. He found no Tsetse at all during this investigation.

As a result of the joint survey made in 1948 in collaboration with the Portuguese Missao de Combate às Thipanosomiases, the Portuguese authorities have now begun control measures on their side of the border. At the end of the year they put into operation a fly-chamber on the road between Changara and the border, and they have undertaken game control in the area since the middle of the year.

As in 1948, no cases of trypanosomiasis were reported from the Chikwizo Native Reserve.


SOUTHERN RHODESIA
Scale of Miles
TSETSE
DISTRIBUTION
G. MORSITANS
AREA INFESTED 1949.
AREA RECLAIMED
SINCE 1930.
19TH. CENTURY LIMITS
G. PALLIDIPES
G. BREVIPALPIS
NORTHERN RHODESIA
PORTUGUESE EAST AFRICA
BECHUANALAND
TRANSVAAL
LIVINGSTONE
VICTORIA FALLS
WANKIE
HANGANI
GWELO
SOUTHERN BOUNDARY
GATOOMA
SALISBURY
MARANDELLAS
CHARTER
UMTALI
BUHERA
CHILIMANZI
SELUKWE
NYAMANDHLOVU
BUBI
BULAWAYO
INSIZA
BELINGWE
GWANDA
NUANETSI
MAZOE
MTORO
DARWIN
LOMAGUNDI
HARTLEY
GWELO
MELSETTER
BIRITA
VICTORIA

Eastern Border (Chipinga).

Eighty-seven positive cases of animal trypanosomiasis, involving 19 farms, were diagnosed during 1949. This number does not differ significantly from the number (96) diagnosed in 1948, but their distribution was rather different in that more than twice as many farms were involved in 1949, of which many reported only one case. The principal outbreak was on Mount Silinda where 27 cases were reported early in the year. This was probably due to native-owned cattle straying across the clearing to the Tsetse infested Portuguese side and bringing fly or infection back with them. A little extra clearing was done in the presumed area of infection, and the situation was brought under control by treatment of animals by the Veterinary Department. No cases attributable to this outbreak occurred after June. On the group of farms Lettie Swan, Stirling, Confidence and Pendragon, there was no recurrence of the rather severe outbreak of 1948, 25 cases (the same number as in 1947) being reported, as against 85 in 1948. No cases were reported North of the Lusitu River.

During the year 82 (111)* Tsetse were caught in and near the border clearing in the normal course of Tsetse Fly Operations. In addition, a further 62 (0) flies were caught in January close to the border clearing in Portuguese territory, not in the course of normal operations but by a new Ranger learning the habits of Tsetse. Only 4 (7) of the Tsetse were caught in Southern Rhodesian territory, and all of these were close to the Portuguese border.

Of the total number 45 (88) were caught in traps, namely, 2 (19) *G. morsitans* and 43 (69) *G. pallidipes*. The remaining 37 (23) caught on man or while resting on paths comprised 7 (8) *G. pallidipes*, 26 (2) *G. brevipalpis*, and 4 (3) *G. morsitans*, and of the four caught in Southern Rhodesia 2 (4) were *G. pallidipes*, 2 (1) *G. brevipalpis*, and 0 (2) *G. morsitans*.

Owing to the progressive easing, referred to last year, of the work of maintaining the clearing, it was possible to do more new clearing amounting in all to just over 3,000 acres on the farms Mount Silinda, Mayfield, Wolverhampton, Vermont and Pendragon. In addition, regrowth was cut back on almost the whole of the main and subsidiary clearings. This work was carried out with a lesser number of natives and for most of the year with only two European Rangers, and the total cost was lower in spite of the rise in price of certain essential commodities and in wages. A good burn of the whole main and subsidiary clearings was obtained in September and October, the forests of Chirinda and Chipete having been effectively protected by fire-guards.

Sabi Valley.

In order to ascertain whether it would yet be advisable to reintroduce cattle into the Northern part of this area adjoining the Portuguese border, a Tsetse Survey was carried out in Portuguese territory North of the Ndanga River. *G. morsitans* was

* Figures in parentheses are the comparable figures for 1948.

found to be abundant on the Chingera River and less numerous on the Murongwesi River, and at Madiningana Salt Pan. The Nyadonga River was found to be free from fly and here a considerable number of cattle were located. Blood smears taken from these cattle did not show the presence of trypanosomiasis. A few cattle are kept near the Murongwesi River. One of these had recently died and a smear from another showed the presence of *T. congolense*. It was thus decided that it would not be advisable to introduce cattle into the neighbourhood of the Musaswe River.

South of this area the heavy concentration of *G. morsitans* about the Honde and Ndanga Rivers in Portuguese East Africa persists. Two Tsetse were caught in Southern Rhodesia, both close to the Rupembe River, a few yards from the Portuguese border.

No cases of trypanosomiasis have been reported in Southern Rhodesia in this area.

TRAFFIC CONTROL.

Two new traffic cleansing pickets were established during the year. One of these is situated at the Midway Mine at the top of the Zambesi escarpment on the newly-made road from Nzoe Mine to Chipisa Mine. This picket is to prevent Tsetse from being brought up the escarpment into the Urungwe Native Reserve. A barrier has also been placed near the Nagupande drift on the road from the Tsetse Fly Ranger's camp at Lusulu (Sebungwe District) to Gwaai Bridge, to eliminate the possibility of Tsetse being carried to the cattle on the Karna Block and further west. No records have been kept at this point. The other four control points, all in the Urungwe District, remain, but the fly-chamber at Vuti fell into such a bad state of repair that its use was discontinued in December, and it was replaced by a gate. A new chamber is in course of construction for erection at Makuti.

The following traffic was examined at the Urungwe District control points:—

Vuti Chamber.

2,913 motor cars, bringing	14 fly (11 male, 3 female)
1,161 pedestrians, 304 cyclists (541 parties), bringing	3 fly (3 male, 0 female)
Total	17 fly (14 male, 3 female)

Compared with 1940 (25); 1941 (67); 1942 (49); 1943 (56); 1944 (27); 1945 (29); 1946 (23); 1947 (20); 1948 (11).

Catkin Chamber.

320 motor cars, bringing	18 fly (15 male, 3 female)
1,744 pedestrians, 696 cyclists (1,044 parties), bringing	73 fly (53 male, 20 female)
Total	91 fly (68 male, 23 female)

Compared with 1944—5 months only—(15); 1945 (61); 1946 (37); 1947 (28); 1948 (34).

Makuti Gate.

2,992 motor cars, bringing	782 fly (576 male, 206 female)
1,415 pedestrians, 672 cyclists (1,125 parties), bringing	936 fly (736 male, 200 female)
Total	1,718 fly (1,312 male, 406 female)

Compared with 1944—4 months only—(100); 1945 (562); 1946 (703); 1947 (764); 1948 (504).

Chirundu Gate.

2,393 motor cars, bringing	466 fly (365 male, 101 female)
1,020 pedestrians, 175 cyclists (363 parties), bringing.....	192 fly (144 male, 48 female)
Total	658 fly (509 male, 149 female)

Compared with 1940 (360); 1941 (119); 1942 (276); 1943 (746); 1944 (437); 1945 (485); 1946 (incomplete, 319); 1947 (211); 1948 (214).

Midway Barrier (6 months only).

235 motor cars, bringing	40 fly (28 male, 12 female)
5,121 pedestrians, 124 cyclists (1,353 parties, bringing	130 fly (84 male, 46 female)
Total	170 fly (112 male, 58 female)

An explanation for the marked increases in fly caught is offered earlier in this report.

Contributing to the increase has also been the increase of about 40 per cent. in traffic at all stations, as compared with 1948.

Some Notes on the Water Act, as amended, 1949

By P. H. HAVILAND, B.Sc., M.I.C.E.,
Director of Irrigation.

General.

The Water Act (Chapter 251, Revised Edition of the Statute Law, 1939), was amended in a number of major directions by the Water Amendment Act No. 8 of 1949, and in certain minor ways by the Water Amendment Act No. 34 of 1947. It is probable that many farmers and others are not aware of the effect of these amendments, and so a few notes on the Act as now in force may be of value. In submitting these notes, it must be made quite clear that **they do not constitute legal rulings, nor are they comprehensive, and are prepared only for the general guidance of the public.**

The Act may be said to control the use of water in such a way as to achieve the most beneficial effects to the Colony as a whole, and is essentially modern in its framework.

Water Vested in Governor.—Rights Attach to Land.

All water other than "private water" is vested in the Governor, NOT the Government, and its use, diversion and apportionment is controlled by the terms of the Act.

All water rights attach to the land and not to any individual.

Private Water.

"Private Water" is defined as water which naturally rises, falls or drains on to any land, provided such water is not naturally capable of entering any water-course of natural origin. This virtually confines "private water" to water in lakes, to springs from which the flow disappears before it can reach any natural water-course and to water in vleis which cannot have any effect, direct or indirect, on the flow of any stream; consequently it can be said that there is practically no private water in the Colony.

Public Stream—Public Water.

A "public stream" is a water-course of natural origin in which water flows in ordinary seasons, whether or not the water-course is dry during any period of the year. "Public water" is any water in a public stream, and it is this water which is controlled in a practical form by the Water Act.

Primary Use.

It is important to know what is meant by "primary use." This is the use of water for human use or in or about a dwelling, and also the use of water for the support of animal life. The amount of water, other than that required for animals, is limited to 50 gallons per day for each person resident in a dwelling, and

no riparian owner, tenant or occupier is permitted to use any water in excess of this. The total quantity of water is, therefore, calculated at 50 gallons per day multiplied by the number of persons in a dwelling, irrespective of colour or race, and may be used on gardens, for water-borne sewage purposes or anything else.

If it is necessary, water for the support of animal life may be impounded in dams or may be diverted for the purpose by riparian owners, tenants or occupiers, but the water so impounded or diverted must not be more than is essential.

Secondary or Irrigation Use.

The use of water for irrigation purposes, that is, "secondary use," can only be effected after a right has been granted by a Water Court.

Tertiary Use.

The "tertiary use" of water can only be resorted to after a Water Court has granted the right. "Tertiary use" of water is the use for any purpose except primary, secondary, mining, railway and urban purposes, and it includes the use of water for general conservation and for fish farming.

Mining Use.

The rights which prospectors or the holders of mining locations have under the Mines and Minerals Act, in respect of the use of water for primary purposes or in respect of subterranean water or water directly due to rainfall before it joins a public stream, are preserved under the Water Act.

Any person requiring water for mining purposes may be granted it by a Water Court.

If such water is being used beneficially for irrigation by some other person under a right granted in terms of the Water Act or any other law, a Water Court may grant the miner's application but only on payment of compensation to the person to whose land the irrigation right attaches. The compensation payable is limited to 75 per cent. of the full extent of the loss or damage suffered as a result of the deprivation of the use of the water for irrigation.

The rights to the use of water attach to the claims and pass with any transfer of claims, but upon abandonment or forfeiture of the claims these rights lapse.

Railway and Urban Use.

Special provisions exist in the Act for the granting of water rights for railway and for urban purposes.

Railway rights can be obtained only by a person, partnership or company authorised by law to construct or operate a railway.

Urban rights can be obtained only by a local authority.

Riparian Owners', Tenants' and Occupiers' Rights.

A "riparian owner," that is, the owner of land on which or along the boundary of which there is a public stream, has certain advantages over a non-riparian owner. In the first place, he

has the right, without any reference to a Water Court, to impound, divert or take any public water for "primary use," and this right extends also to any occupier or tenant of riparian land. Secondly, he has, unless it is otherwise in the public interest, a prior claim over non-riparian owners to be allocated by a Water Court public water for irrigation or other purposes; non-riparian owners can only obtain these rights if the water is not being beneficially used by riparian owners or if a Water Court, after considering a recommendation by the Minister, is satisfied that the use of water by a non-riparian owner is in the public interest.

Rights of Public.

As travellers and other persons may require public water for the immediate purpose of watering stock, drinking, washing or cooking, or use in a vehicle, the Act provides that they may take such water at any time provided they have legal access to the public stream, which in general means that they may use the water if on a public road, outspan, etc,; these persons, however, have no right to divert or abstract this water for "primary use."

Priority of Right of Use.

If at any time there is insufficient water in a public stream to satisfy all the rights to the use of water which exist on that stream, then the order in which they must be satisfied is:—

(1) all primary rights;

(2) rights to the use of water for irrigation purposes;

(3) rights to the use of water for tertiary purposes.

Within the category of irrigation purposes no holder of rights may make use of these rights **until the rights of prior holders have been satisfied.** If an upper riparian owner has a right with a priority later than some lower riparian owner, then he must allow to pass down the river such an amount of water as is necessary for the lower owner's requirements before he attempts to satisfy his own rights.

A similar position applies within the category of tertiary rights.

Failure to Use Rights.

If the holder of any right to the use of water for secondary or tertiary purposes does not make full use of the rights for three consecutive years, a Water Court may cancel the rights or reduce them unless the holder can satisfy the Court that the failure to use them or to use them fully was not due to his fault or neglect.

It is essential that all returns relating to the use of water sent out by the Water Registrar be returned expeditiously and **completed accurately.**

Servitudes.

Any person who has been granted the right to the use of water may claim certain servitudes over the land of another, if it is essential to the enjoyment of the right. Such servitudes are those necessary to store water, to enable its passage over

or under land, or to build storage works or erect pumping plant on another's land. If no agreement is come to between the parties, then a Water Court will adjudicate on the matter. The procedure for making claims for servitudes is detailed in the Act.

A servitude may be acquired by agreement between parties, but such a servitude, if not registered, is binding **only on the original parties** to the agreement, and if one of the parties dies, disposes of his land or otherwise ceases ownership, the agreement is null and void.

It is most desirable, therefore, that the agreement should be registered on the title of all land against and in favour of which servitude has been acquired.

Registration is effected through the Water Registrar who will inform applicants as to what is required which, among other things, includes the submission of copies of a diagram of the servitude areas framed by a Government land surveyor or a Government irrigation engineer.

No Final Grants will be issued in future where servitudes are required unless such servitudes have been obtained.

Applications for Use of Water.

Forms of application for each particular use of water are obtainable from the Water Registrar, Department of Justice, Salisbury.

Completion of Forms must be done carefully and **all information** asked for must be given.

When the Registrar has received the form, and provided it is completed correctly, he publishes a notice in the "Gazette" calling for any objections to the application to be lodged within a period stated in the notice.

At the same time he calls for reports from the Chief Hydrographic Engineer and the appropriate Circle Engineer of the Irrigation Department and when necessary reports from the Department of Conservation and Extension in relation to land use.

Hearing of Cases.

The Water Court operates on circuits, visiting different parts of the Colony at different times of the year.

A notice is published annually in the "Gazette" giving the month when the Court will sit at various centres, and the dates by which applications must be received by the Water Registrar. **Applications put in after these dates will not be accepted for the normal circuits.**

Completion of Works.

When a Court deals with an application it issues a Provisional Order, which order provides for the use of water until the completion of all the works and conservation measures which are necessary to the issue of a Final Grant. In this Provisional Order the period in which the works and measures must be completed is stated.

Should, for good cause, an applicant not be able to complete the works within the time specified he may apply to the Water

Registrar for an extension of time and, in doing so, must submit an affidavit sworn before a Justice of the Peace or Commissioner of Oaths as to the reasons for the delay.

If the Water Court, or if a Court is not sitting the Water Court Judge, is satisfied that the reasons are sound an extension of time, as considered reasonable by the Court or Judge, may be given.

Final Grants.

Before a Final Grant can be issued by the Water Registrar a certificate has to be submitted by an officer of the Irrigation Department stating that all the works and measures stipulated in the Provisional Order have been completed.

It is essential, therefore, that holders of Provisional Orders should **complete all** these works and measures within the time specified or as extended.

Storage of More than One Million Gallons.

A new section in the Act makes it obligatory on any person who intends to construct a storage work holding more than one million gallons to notify the Director of Irrigation in writing of the details of the work, unless the safety of the work has been considered by a Water Court. This does NOT mean that the Director can authorise the storing of the water or the use of the water. The storage and use of water is authorised only with the authority of a Water Court unless it is for primary use, and, if the latter, the onus is on the person building the work to ensure that only sufficient is stored for his "primary" requirements, including such water as is necessary to offset evaporation and other natural losses.

Sub-Division of Land with Rights Attached.

If any land in respect of which water rights have been granted, or any "scheduled irrigable land" in a combined Irrigation Scheme, is sub-divided under an agreement between the seller and purchaser providing for an apportionment of the existing water rights, **this agreement will have no force unless and until it is approved of by a Water Court.**

If no agreement is made, a Water Court, either on its own motion or after an application is made by any interested party, may make such an apportionment of the existing rights as appears to be reasonable to it.

Prospective purchasers and sellers are advised to bear this matter in mind.

Disputes Between Users.

If there is any dispute regarding the use, diversion, control or appropriation of water, the matter can be brought before a Water Court. Should, however, the parties to the dispute so desire, a dispute may be referred to a Water Court Judge, and if the parties agree beforehand, his award can be made final and conclusive. A new provision also makes it possible for a dispute to be referred to the Director of Irrigation, and his award will

be binding on the parties unless or until it is set aside either by agreement between the parties or by order of a Water Court.

Offences.

It is advisable that the public should know something about the offences and penalties under the Water Act, and the following is the applicable extract:—

"122. Any person who, without lawful right or authority (the proof whereof shall lie upon him)—

(a) alters, enlarges or obstructs an irrigation work, or destroys, defaces or moves any level mark, beacon or other structure or appliance erected or made in connection with such work;

(b) impounds, diverts or takes any public water;

(c) interferes with or alters the flow of or pollutes or fouls the water of an irrigation work or of a public stream or interferes with the distribution of such water, or, after notice to refrain from doing so, takes more water than he is entitled to, or uses it in a manner contrary to this Act or the regulations made thereunder;

(d) while using or being liable for the maintenance of an irrigation work, to the prejudice of others wastes or does not take due precaution to prevent the waste of water from such work, or fails properly to maintain the work and keep it in repair;

(e) wastes the water of a public stream;

(f) being the proprietor of an area, after notice from the Minister or other official authorised by him, fails to put an end to waste of water resulting from the act of a tenant or other person deriving rights from such proprietor and no longer present on such area;

(g) aids or abets or knowingly permits any such act or default; or

(h) constructs any well, shaft, borehole or other work or does any other thing which is intended to have the effect of abstracting public water or water lawfully diverted or stored by any other person;

(i) interferes with the bed, banks or course of a public stream or any swamps or marshes forming the source of a public stream or found along its course;

(j) contravenes or fails to comply with any bye-law made in terms of section seventy-nine of this Act;

shall be guilty of an offence, and liable—

(i) in the case of a first conviction, to a fine not exceeding twenty-five pounds, or in default of payment to imprisonment for a period not exceeding six months, or to both such fine and such imprisonment;

(ii) in the case of a second or subsequent conviction, to a fine not exceeding one hundred pounds, or in default of payment to imprisonment for a period not exceeding one year, or to both such fine and such imprisonment.

123. Any person who wilfully or maliciously commits any of the acts mentioned in paragraphs (a) and (b) of the last preceding section shall be liable to a fine not exceeding five hundred pounds, or to imprisonment for a period not exceeding two years, without the option of a fine.

123A. Any person who, except under and in accordance with the written permission of the Director of Irrigation, places any poison in any **public or private water** shall be guilty of an offence and shall be liable to a fine not exceeding five hundred pounds or to imprisonment for a period not exceeding two years.

124. Any person who commits an offence against this Act or any regulation made thereunder, for which no penalty is expressly provided, shall be liable to a fine not exceeding twenty-five pounds, or in default of payment to imprisonment for a period not exceeding six months.

125. (1) Whenever any person is convicted by a court of an offence against this Act or the regulations made thereunder, and it appears that such person has by that offence caused damage to any person, such court may, at the written request of such person, but in the presence of the convicted person, enquire summarily and without pleadings into the amount of damage so caused.

(2) Upon proof of such amount, such court shall give judgment therefore in favour of the applicant and against the convicted person, and such judgment shall be of the same force and effect and be executable in the same manner as if it had been given in a civil action duly instituted before such court:

Provided that judgment shall not be given under this section for a sum exceeding the civil jurisdiction of such court."

Reporting Offences.

The commission of offences should be reported to the Police for appropriate action and NOT to the Water Registrar or Irrigation Department.

It might, however, be advisable to notify the Irrigation Department of any offences **reported.**

Productivity and Nutritive Value of Star Grass Pastures

By H. WEINMANN, Dr.Agric.,D.Sc., Pasture Research Chemist.

Star grass (*Cynodon plectostachyum Pilger*) seems to be one of the most promising fodder grasses for the granite sandveld areas of high rainfall in this Colony. At the Marandellas Grassland Research Station, Star grass pastures have given excellent results for a number of years, and Staples (9) considers that "the carrying capacity of these planted pastures appears to be as much as five times that of natural veld." Investigators in East Africa (1, 2), the homeland of this species, as well as in Australia (7, 8) and India (6) have favourably commented on the nutritive value and productivity of strains of this grass.

The present work was carried out at the Marandellas Grassland Research Station, and included investigations on the seasonal growth and chemical changes of two strains of Star grass (known as Star grass No. 2 and No. 4), and on the effect of different amounts of ammonium sulphate on the yield and chemical composition of Star grass No. 2. The properties of these grasses and methods of their establishment, etc., have been discussed by Rattray (5). Of the two varieties Star grass No. 2 is more suitable for grazing, and No. 4 for hay-making. The soil at the Marandellas Research Station is an acid granitic sand of low fertility, an analysis of which has been given in a previous paper (10). The annual rainfall during the period over which this investigation extended was 45.8 inches in 1947/48, 27.7 inches in 1948/49, and 27.6 inches in 1949/50.

SEASONAL GROWTH AND CHEMICAL CHANGES.

In December, 1947, two half-acre plots of Star grass No. 2 and No. 4 were established. The runners were planted in holes three feet by three feet apart, and a double handful of compost was mixed into each hole. 200 lb. of superphosphate per acre had been applied before planting, and 50 lb. of ammonium nitrate were given soon afterwards. The grass made good growth and produced a satisfactory cover during the same season. The herbage was cut on 13th May, 1948. The dry matter yields and chemical composition are shown in Table I.

TABLE I.

YIELDS AND CHEMICAL COMPOSITION OF STAR GRASS (13th May, 1948).

Results of the chemical analysis expressed on the dry basis.

Strain	Yield lb. p. acre	Protein %	Ash Acid-sol. %	P_2O_5 %	K_2O %	CaO %
Star Grass No. 2	4,360	7.1	5.9	0.74	2.8	0.54
Star Grass No. 4	4,520	5.7	4.3	0.60	1.8	0.44

In the 1948/49 season one-half of each plot was fertilised (NP), receiving 200 lb. of super-rockphosphate mixture (1:1) plus 100 lb. of sodium nitrate per acre in November, 1948, and a further dressing of 100 lb. of sodium nitrate on 4th March, 1949. The other half of each plot remained unfertilised (0). Between November, 1948, and June, 1949, two quadrats of two yards by two yards area were cut in each treatment at the beginning of each month, new quadrats being cut every time. The quadrats cut in January were cut again in May, and those cut in December were cut again in March and June. The samples were used for the determination of the dry matter yields as well as for chemical analysis. During the winter months random samples were taken which were analysed for protein.

The grasses flowered in January and February, the No. 2 strain being in advance of No. 4, and also forming more flower heads. By the beginning of May the herbage was rather mature and yellowish, but Star grass No. 2 retained some green leaves until the beginning of August.

Dry Matter Yields, 1948/49. The results of the yield determinations are given in Table II. While the seasonal growth figures show some irregular fluctuations, obviously due to sampling errors, they nevertheless indicate consistently higher yields for the fertilised plots. With one cut per season dry matter yields amounted to 1 to 1½ tons per acre, but with two cuts total yields exceeding two tons of dry matter per acre were obtained in the fertilised plots.

Chemical Composition of the Herbage, 1948/49. The results of the chemical analysis are shown in Tables III and IV. The percentages of protein, acid-soluble ash, phosphoric oxide and potash decreased with the advance of the season, while the lime content remained more or less constant or showed even an increase towards the end of the season. As will be seen from Fig. 1, the protein content was fairly high (nearly 15%) in the young herbage but dropped to 5-6% during the months of November and December, i.e., during the period of most rapid growth, after which time the decrease was only a gradual one. The application of nitrogenous fertiliser raised the percentage of protein and also produced a herbage of darker green colour, but the differences usually did not last for more than two months. In the protected

grass the protein content had dropped to 4% and less by the beginning of June, but herbage cut previously in December and March contained still more than 5% (and in one case more than 6%) of protein. The rainfall was low in this season, particularly the months of January and February being very dry, and it is thought that this resulted in a rapid maturation of the herbage and hence in a relatively low protein content. It should also be mentioned that these samples included not only shoots but also stolons (runners)* and, as will be shown below, stolons, especially when old, are considerably lower in protein than shoots.

The phosphoric oxide content of the two strains of Star grass ranged from about 1.3 to 0.4%, and the lime content from 0.75 to 0.4%; in the herbage cut at three monthly intervals the phosphoric oxide content averaged 0.7% and lime 0.6%. The mineral content of Star grass thus compares very favourably with that of ordinary veld grass, in which phosphoric oxide and lime content usually vary from 0.2 to 0.4% of the dry matter.

TABLE II.

YIELDS OF STAR GRASS, 1948/49 SEASON.

In pounds dry matter per acre.

Date	Star Grass No. 2		Star Grass No. 4		Rainfall* ins.
	O	NP	O	NP	
SEASONAL GROWTH					
5/11/1948	590	—	470	—	5.09
3/12/1948	1,140	1,360	850	1,260	7.93
4/1/1949	2,360	3,050	2,080	2,650	4.50
1/2/1949	1,700	2,150	2,115	3,430	2.65
1/3/1949	2,220	3,390	2,720	3,040	2.79
1/4/1949	2,230	2,870	2,310	3,010	3.95
3/5/1949	2,140	3,020	3,100	3,860	0.33
1/6/1949	2,240	3,100	2,680	3,170	0.30
TWO CUTS PER SEASON (JANUARY AND MAY)					
4/1/1949	2,360	3,050	2,080	2,650	—
3/5/1949	1,550	1,600	1,720	2,240	—
Total	3,910	4,650	3,800	4,890	—
THREE CUTS PER SEASON (DECEMBER, MARCH AND JUNE)					
3/12/1948	1,140	1,360	850	1,260	—
1/3/1949	1,600	1,850	1,730	1,950	—
1/6/1949	510	870	420	610	—
Total	3,250	4,080	3,000	3,820	—

* For month preceding respective sampling date.

Protein Content of the Herbage in 1949/50. All old herbage was removed from the plots in September, 1949. The fertiliser treatments were continued during this season, but the amounts of nitrogen were doubled as compared with those used in the previous year. 100 lb. of super-rockphosphate mixture per acre were given on 15th December, 1949; 200 lb. of sodium nitrate were applied on 16th December, 1949, and again on 3rd March, 1950. No yield determinations were done during this season but random samples of herbage were taken at monthly intervals from December, 1949, to May, 1950, and were analysed for protein. The results are indicated in Table V.

Rains were late in this season, and the first samples taken at the beginning of December were of very young herbage and hence very high in protein. Though January was again a dry month, the total rainfall was higher than in 1948/49. The seasonal protein curves are very similar to those of the preceding year, showing again a rapid decline in the first part of the growing season but remaining at a somewhat higher level. As might be expected, the effect of the nitrogenous fertiliser was more pronounced than in the previous seasons when only half the amount of sodium nitrate had been used.

TABLE III.

SEASONAL CHANGES IN THE CHEMICAL COMPOSITION OF STAR GRASS, 1948/49.

Constituents as Percentages of the Dry Matter.

Sampling Date	Star Grass No. 2		Star Grass No. 4	
	O	NP	O	NP
	PROTEIN			
5/11/1948	14.61	—	14.82	—
3/12/1948	6.90	9.00	10.92	12.11
4/1/1949	4.63	5.15	5.82	6.42
1/2/1949	5.10	5.05	5.87	5.98
1/3/1949	4.88	4.89	4.67	4.83
1/4/1949	4.85	5.66	5.01	6.87
3/5/1949	3.79	5.43	3.52	4.01
1/6/1949	3.61	4.33	3.36	3.03
5/7/1949	3.81	4.43	3.29	3.56
2/8/1949	3.44	3.78	2.87	3.06
6/9/1949	3.02	3.48	2.83	2.95

ACID-SOLUBLE ASH				
5/11/1948	7.98	—	7.10	—
3/12/1948	5.67	6.10	5.29	5.64
4/1/1949	4.24	4.39	3.77	4.36
1/2/1949	3.83	3.85	3.47	3.81
1/3/1949	3.89	4.28	3.05	3.44
1/4/1949	3.49	4.45	2.92	3.28
3/5/1949	3.21	4.25	2.35	2.54
1/6/1949	2.82	3.31	2.23	2.27
PHOSPHORIC OXIDE				
5/11/1948	1.33	—	0.79	—
3/12/1948	1.05	0.92	0.78	0.99
4/1/1949	0.67	0.59	0.59	0.68
1/2/1949	0.54	0.68	0.63	0.67
1/3/1949	0.52	0.77	0.57	0.68
1/4/1949	0.57	0.87	0.63	0.57
3/5/1949	0.53	0.85	0.45	0.42
1/6/1949	0.43	0.51	0.43	0.46
POTASH				
5/11/1948	3.79	—	3.61	—
3/12/1948	2.79	3.03	2.55	2.69
4/1/1949	2.09	2.65	1.92	2.14
1/2/1949	1.76	1.84	1.57	1.85
1/3/1949	1.71	1.86	1.33	1.47
1/4/1949	1.45	1.79	1.11	1.29
3/5/1949	1.19	1.62	0.80	0.90
1/6/1949	0.79	1.09	0.65	0.56
LIME				
5/11/1948	0.60	—	0.54	—
3/12/1948	0.43	0.55	0.51	0.59
4/1/1949	0.39	0.47	0.44	0.45
1/2/1949	0.51	0.49	0.51	0.53
1/3/1949	0.61	0.73	0.53	0.58
1/4/1949	0.60	0.73	0.56	0.49
3/5/1949	0.59	0.75	0.50	0.56
1/6/1949	0.68	0.71	0.50	0.60

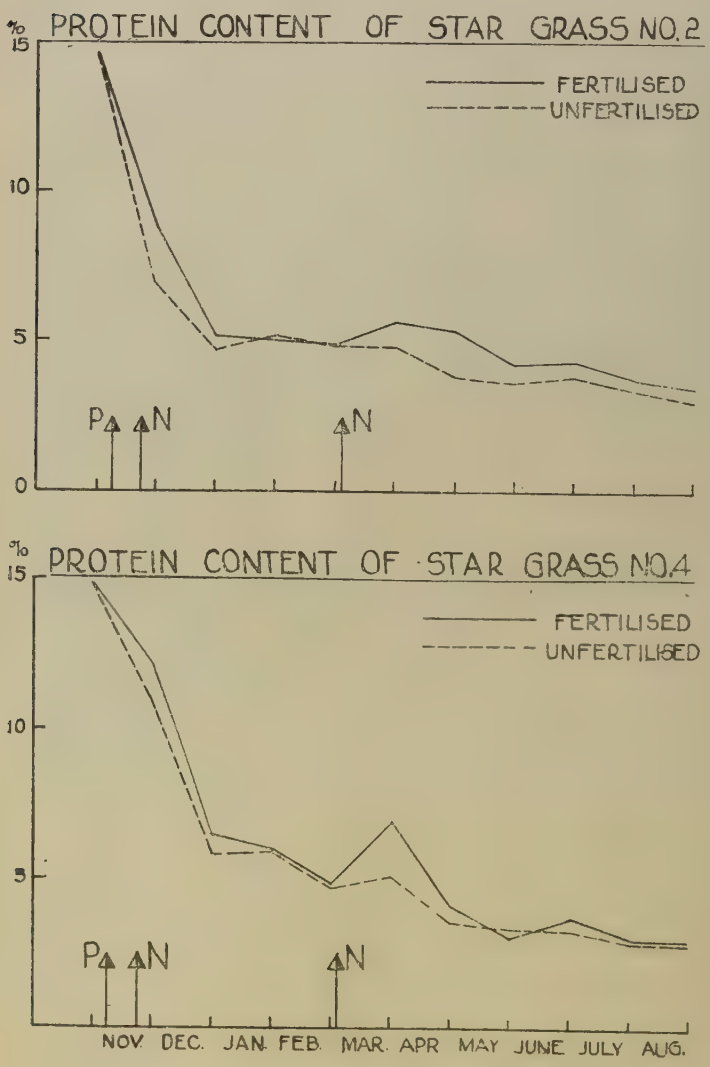


Fig. 1.—Seasonal Trends of the Protein Content of Star Grass (1948-49.) (The dates of application of phosphate and sodium nitrate are indicated by arrows.)

Sheep on a Star Grass pasture in its fourth year on Grassland Research Station, Marandellas. These pastures have been found particularly useful in maintaining the flock through the dry season months.

[Photographed by Mr. C. K. Thompson.

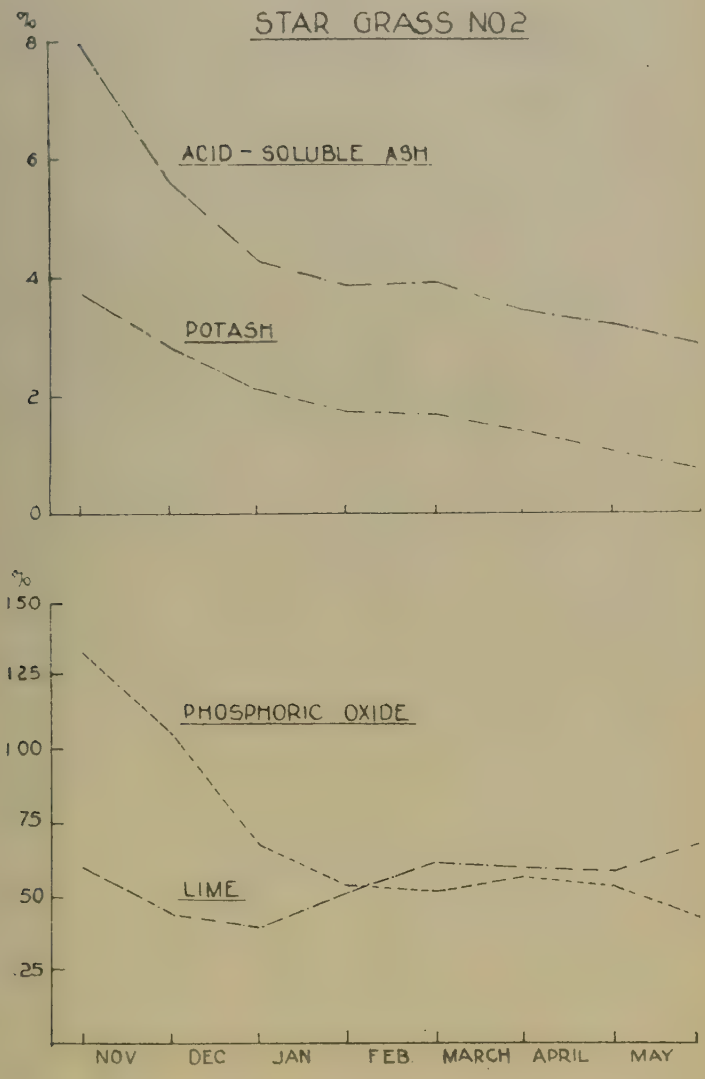


Fig. 2.—Seasonal Changes in the Mineral Content of Unfertilised Star Grass No. 2 (1948-49).

TABLE IV.

CHEMICAL COMPOSITION OF STAR GRASS CUT TWICE OR THREE TIMES PER SEASON (1948/1949).

Constituents as Percentages of the Dry Matter.

Sampling Date	Star Grass No. 2 O	Star Grass No. 2 NP	Star Grass No. 4 O	Star Grass No. 4 NP
Two Cuts per Season (January and May).				
PROTEIN				
4/1/1949	4.63	5.15	5.82	6.42
3/5/1949	4.60	6.20	4.12	4.89
Average	4.62	5.68	4.97	5.66
ACID-SOLUBLE ASH				
4/1/1949	4.24	4.39	3.77	4.36
3/5/1949	3.74	4.28	2.76	3.18
Average	3.99	4.34	3.27	3.77
PHOSPHORIC OXIDE				
4/1/1949	0.67	0.59	0.59	0.68
3/5/1949	0.70	0.66	0.49	0.50
Average	0.69	0.63	0.54	0.59
POTASH				
4/1/1949	2.09	2.65	1.92	2.14
3/5/1949	1.67	1.85	1.09	1.19
Average	1.88	2.25	1.51	1.67
LIME				
4/1/1949	0.39	0.47	0.44	0.45
3/5/1949	0.57	0.67	0.55	0.57
Average	0.48	0.57	0.50	0.51
Three Cuts per Season (December, March and June).				
PROTEIN				
3/12/1948	6.90	9.00	10.92	12.11
1/3/1949	4.94	5.70	5.21	5.04
1/6/1949	5.89	6.67	5.38	5.48
Average	5.91	7.12	7.17	7.54

ACID-SOLUBLE ASH				
3/12/1948	5.67	5.10	5.29	5.64
1/3/1949	4.67	4.50	3.59	3.95
1/6/1949	4.38	4.37	2.95	3.52
Average	4.91	4.99	3.94	4.37
PHOSPHORIC OXIDE				
3/12/1948	1.05	0.92	0.78	0.99
1/3/1949	0.88	0.76	0.58	0.77
1/6/1949	0.63	0.56	0.41	0.51
Average	0.83	0.75	0.59	0.76
POTASH				
3/12/1948	2.79	3.03	2.55	2.69
1/3/1949	1.97	2.03	1.61	1.71
1/6/1949	1.79	1.67	1.24	1.48
Average	2.18	2.24	1.80	1.96
LIME				
3/12/1948	0.43	0.55	0.51	0.59
1/3/1949	0.53	0.58	0.46	0.50
1/6/1949	0.72	0.84	0.47	0.51
Average	0.56	0.66	0.48	0.53

TABLE V.

SEASONAL CHANGES IN THE PROTEIN CONTENT OF STAR GRASS, 1949/50.

Crude Protein as Percentage of the Dry Matter.

Date	Star Grass No. 2		Star Grass No. 4		Rainfall*
	O	NP	O	NP	ins.
1/12/1949	17.30	—	23.40	—	2.80
4/1/1950	8.26	11.96	8.40	12.40	8.58
1/2/1950	6.04	6.42	5.41	7.34	2.60
28/2/1950	6.35	6.52	7.24	7.37	5.14
30/3/1950	6.34	7.51	6.09	8.04	6.53
27/4/1950	5.44	5.75	4.52	5.82	1.69

* For month preceding respective sampling date.

General Conclusions. The results of these investigations indicate that the protein content of Star grass No. 2 and No. 4 is very high when the grass is young, but rapidly drops during the first part of the growing season, and then more slowly during maturation. Repeated cutting and applications of nitrogenous fertiliser kept the protein content at a somewhat higher level. The phosphorus and lime content of the two strains of Star grass was at all stages of growth superior to that of indigenous veld grasses. It remained to be seen, to what extent the quality and productivity of the Star grass could be improved by the use of larger applications of nitrogenous fertilisers combined with suitable pasture management.

EFFECT OF AMMONIUM SULPHATE ON A STAR GRASS PASTURE.

In 1949 it was decided to lay out a fertiliser experiment in a pasture of Star grass No. 2 at the Marandellas Grassland Research Station. This pasture had been established in March, 1947, when the Star grass was planted under a maize-bean silage crop. The pasture was grazed from November, 1947, onward, though with certain rest periods. Apart from 100 lb. of rockphosphate per acre, applied in 1947/48, no fertiliser had been used on the pasture before the present experiment was laid out.

In March, 1949, 14 plots of five yards by five yards each were pegged off, which were to receive the following fertiliser treatments:—

		Pounds per Acre	
		Superphosphate	Ammonium Sulphate
(1)	O	—	—
(2)	P	200	—
(3)	NP	200	100
(4)	N_2P	200	200
(5)	N_4P	200	400
(6)	N_6P	200	600
(7)	N_8P	200	800

Each of these treatments was represented by two plots. The phosphate was applied on 4th March, 1949; the mode of application of the various ammonium sulphate treatments during the 1948/49 season is indicated in the following plan:—

Lb. Ammonium Sulphate per Acre Applied in 1948/49.

Treatment	NP	N_2P	N_4P	N_6P	N_8P
4/3/1949	100	200	200	200	200
29/3/1949	—	—	200	200	200
12/4/1949	—	—	—	200	200
2/5/1949	—	—	—	—	200
Totals	100	200	400	600	800

PROTEIN CONTENT OF STAR GRASS No. 2, AUTUMN AND WINTER, 1949.

The pasture, including the plots of this experiment, was grazed by cattle at the end of March, 1949; soon afterwards the experiment was fenced. The plots on which ammonium sulphate was applied produced a darker green herbage and more flower heads than those which received no nitrogen. Frosts were late and light in 1949, and the herbage had many green leaves even as late as July. Samples of herbage were taken from the plots on 1st June and 5th July, and the protein content of the total herbage as well as of shoots and stolons was determined (see Table VI).

TABLE VI.

CRUDE PROTEIN CONTENT OF STAR GRASS No. 2, AUTUMN AND WINTER, 1949.

As Percentage of the Dry Matter.

Treatment	O	P	NP	N_2P	N_4P	N_6P	N_8P
TOTAL HERBAGE							
1/6/1949	4.48	4.29	4.11	5.16	5.40	6.11	6.54
5/7/1949	5.00	3.75	5.56	4.20	5.48	5.29	5.86
SHOOTS							
1/6/1949	6.73	6.39	6.95	7.43	8.36	8.47	9.60
5/7/1949	5.98	5.11	5.40	6.10	6.55	6.75	7.39
STOLONS							
1/6/1949	1.79	1.63	2.00	2.08	2.31	2.38	2.44
5/7/1949	2.00	1.78	1.93	2.05	2.64	2.82	2.67

As will be seen, the protein content of the total herbage as well as of shoots and stolons increased with the rate of application of ammonium sulphate, but the shoots were approximately three times as high in protein as the stolons. In the plots where 800 lb. of ammonium sulphate per acre had been applied the shoots contained as much as 9.6% of protein at the beginning of June and still 7.4% one month later.

INVESTIGATIONS DURING THE 1949/50 SEASON.

During this season yield cuts were taken on 4th January, 1st March and 28th April, 1950, a quadrat of two yards by two yards being harvested in each plot but in a different plot portion at

each sampling date. Dry matter yields, protein, phosphorus and lime content of the herbage were determined, and for the last sampling date also the relative proportions of shoots and stolons in four of the treatments. After each cut cattle were admitted for grazing until all plots were evenly grazed down; in January only three steers were available for grazing, and it was necessary afterwards to cut down the herbage evenly.

The superphosphate (200 lb. per acre) was given on 31st October, 1949, the ammonium sulphate was applied, as indicated in the following table:—

Lb. Ammonium Sulphate per Acre Applied in 1949/50.

Treatment	NP	N_2P	N_4P	N_6P	N_8P
31/10/1949	100	100	100	200	200
29/11/1949	—	—	100	100	200
19/1/1950	—	100	100	100	100
1/2/1950	—	—	100	100	100
3/3/1950	—	—	—	100	100
31/3/1950	—	—	—	—	100
Totals	100	200	400	600	800

Dry Matter Yields. The results of the yield determinations are shown in Table VII and Fig. 3. While the use of phosphate alone had no effect on the herbage yields, these increased markedly with increased applications of ammonium sulphate. The differences were particularly pronounced in the first cut, the larger applications of nitrogen producing a luxurious growth of the Star grass. Considering the combined yields from all three cuts, 400 lb. of ammonium sulphate per acre more than doubled the herbage yield, while 800 lb. more than trebled it. The proportion of stolons (runners) in the herbage appeared to be appreciable only in the last cut, varying from 1/3rd to 1/5th of the total herbage. The application of nitrogen seems to have reduced the proportion of stolons to some extent.

TABLE VII.

YIELDS OF STAR GRASS No. 2, 1949/50.

In Pounds Dry Matter per Acre.

Treatment	O	P	NP	N_2P	N_4P	N_6P	N_8P
4/1/1950	930	820	1,470	1,420	2,410	3,270	4,360
1/3/1950	640	650	800	1,290	1,720	1,860	1,980
28/4/1950	1,100	1,030	1,360	1,300	1,610	2,070	2,430
Totals	2,670	2,500	3,630	4,010	5,740	7,200	8,770

Shoots and Stolons as Percentages of Total Dry Matter Yields (28/4/1950).

Shoots	72.2	66.5	—	—	75.2	—	81.0
Stolons	27.8	33.5	—	—	24.8	—	19.0

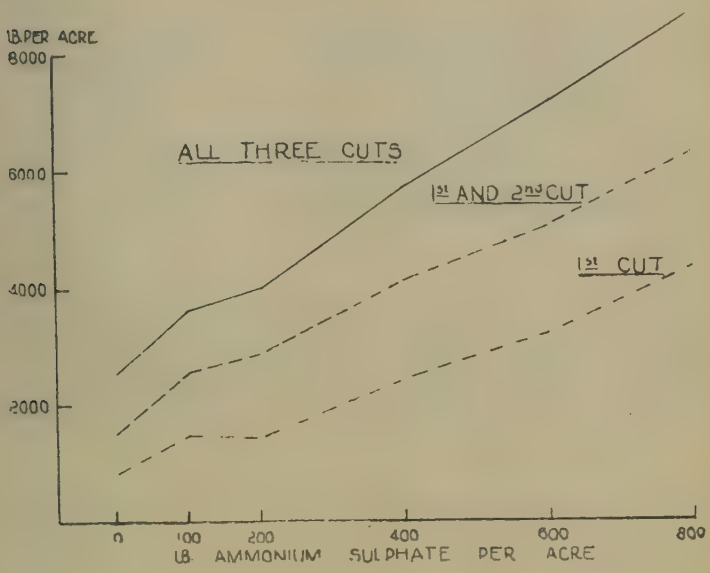


Fig. 3.—Dry Matter Yields of Star Grass No. 2 in Relation to Amount of Ammonium Sulphate Applied (1949-50).

TABLE VIII.

CHEMICAL COMPOSITION OF STAR GRASS No. 2, 1949/50.

Constituents as Percentages of the Dry Matter.

Treatment	O	P	NP	N_2P	N_4P	N_6P	N_8P
CRUDE PROTEIN							
4/1/1950	6.35	6.29	6.83	6.98	8.50	10.10	11.30
1/3/1950	8.75	8.27	8.33	8.38	10.90	10.92	12.16
28/4/1950	5.28	5.72	5.58	5.94	6.45	6.58	7.62
Totals*	6.48	6.58	6.68	7.08	8.65	9.30	10.50
PHOSPHORIC OXIDE							
4/1/1950	0.54	0.64	0.57	0.59	0.56	0.52	0.51
1/3/1950	0.64	0.83	0.66	0.64	0.66	0.58	0.60
28/4/1950	0.47	0.62	0.46	0.47	0.38	0.37	0.38
Totals*	0.52	0.68	0.55	0.57	0.54	0.49	0.50

	LIME						
4/1/1950	0.48	0.53	0.50	0.54	0.51	0.47	0.41
1/3/1950	0.48	0.51	0.45	0.48	0.44	0.49	0.43
28/4/1950	0.46	0.51	0.47	0.45	0.49	0.50	0.45
Totals*	0.48	0.52	0.48	0.49	0.48	0.49	0.43
CRUDE PROTEIN CONTENT OF SHOOTS AND STOLONS (28/4/1950)							
Shoots	6.95	7.49	—	—	7.55	—	8.35
Stolons	2.40	1.99	—	—	2.35	—	2.93

* The percentages of protein, phosphoric oxide and lime for the total yields (combined yields from the three cuts) have been calculated from the total dry matter yields (Table VII) and the total nutrient yields (Table IX). For instance, % protein for the O-Treatment

$$= \frac{173.0 \times 100}{2{,}670} = 6.48.$$

Chemical Composition. According to the results of the chemical analysis (see Table VIII), the protein content of the herbage increased also in this season with the amount of nitrogen applied, reaching 10% and more with the larger applications of ammonium sulphate. The phosphorus content was highest where phosphate only had been applied, and was slightly reduced by large applications of ammonium sulphate. The lime content varied only little but was also highest in the herbage of the P-treatment and lowest with the highest nitrogen dressing. As in the previous year, the shoots were greatly superior to the stolons in their protein content.

Total Nutrient Yields. The calculation of the total yields of nutrients in lb. per acre gives a more complete picture of the total fertiliser effect than the separate consideration of the yields and chemical composition of the herbage. The total yields of protein, phosphoric oxide and lime in the combined herbage from the three cuts are shown in Table IX and Fig 4.

TABLE IX.

TOTAL NUTRIENT YIELDS IN POUNDS PER ACRE.

Star Grass No. 2, 1949/50.

Treatment	O	P	NP	N_2P	N_4P	N_6P	N_8P
Crude Protein	173.0	164.3	242.6	284.1	495.9	669.0	920.0
Phosphoric Oxide	14.0	17.0	19.9	22.7	30.9	35.5	43.5
Lime	12.7	12.9	17.3	19.7	27.8	34.9	37.4

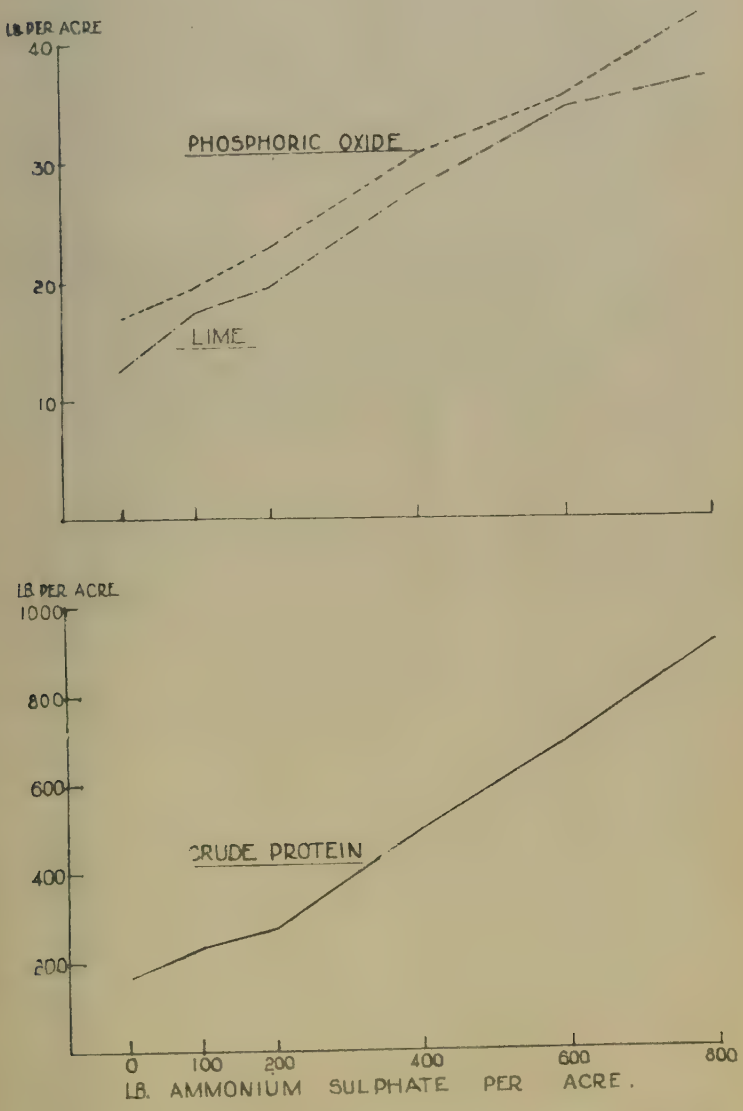


Fig. 4.—Nutrient Yields of Star Grass No. 2 in Relation to Amount of Ammonium Sulphate Applied (1949-50).

As will be seen, the yields of protein as well as of phosphorus and lime greatly increased with the amount of ammonium sulphate applied. In the plots which had received phosphate plus 400 lb. of ammonium sulphate per acre the total yield of protein was approximately three times as high as in the unfertilised control, while the yields of phosphorus and calcium were doubled. With 800 lb. of ammonium sulphate the yield of protein was more than five times, and that of phosphorus and lime three times as high as without fertiliser treatment.

Palatibility of the Herbage. Whenever cattle were admitted to the experiment for grazing, they immediately approached the plots which had received the larger dressings of ammonium sulphate (i.e., 400 lb. per acre and more) and grazed them in preference of the other plots, the herbage of which was eaten only after the heavily fertilised plots had been depleted. The behaviour of the amimals in this respect was essentially the same at all times of the season, and there can be little doubt that the use of large dressings of nitrogenous fertiliser improved the palatibility of the herbage.

Soil Acidity. That the continuous use of ammonium sulphate may increase the acidity of the soil has been demonstrated by previous work in South Africa (4). On 27th April, 1950, soil samples were taken from each plot of this experiment to a depth of about three inches, and their pH was determined. The averages for the various treatments are given, as follows:—

pH of Surface Soil.

Treatment	O	P	NP	N_2P	N_4P	N_6P	N_8P
pH	6.1	5.8	5.5	5.4	5.0	4.8	4.8

As shown by these figures, there was a very distinct increase in the soil acidity with an increase in the amounts of ammonium sulphate used. Dressings of 600 and 800 lb. of ammonium sulphate per acre reduced the pH to the value of 4.8, while the soil of the unfertilised control had a pH of 6.1. Such increased soil acidity can naturally be remedied by the use of agricultural lime, and whenever larger amounts of ammonium sulphate are used for several years, checking of the soil acidity is required from time to time. This is particularly important in the case of grass leys, since subsequent agricultural crops with an optimum pH higher than that of grasses may suffer more severely from the acidity than the grass itself. Such a condition will not arise if instead of ammonium sulphate certain other nitrogenous fertilisers are used on acid soils of this type, such as ammonium nitrate, which does not affect the soil reaction at all, or nitrate of soda, which has the property of neutralising soil acidity. The same applies to rock phosphate, which can be used in place of, or in combination with, superphosphate.

DISCUSSION.

The foregoing data will have shown that Star grass, when properly managed and provided with an adequate supply of fertilisers, can form pastures of very high productivity. In Table X the dry matter and nutrient yields of Star grass No. 2 are compared with those of ordinary veld. While such results naturally vary from year to year and also for different regions, the comparison nevertheless indicates how vastly superior in productivity Star grass pastures can be to natural veld.

TABLE X.

COMPARISON OF VELD HERBAGE AND STAR GRASS.

Dry Matter and Nutrient Yields in Pounds per Acre.

	Veld Herbage*		Star Grass No. 2		
	Grasses only	Grasses & Herbs	O	N_4P	N_8P
Dry Matter	1,080	1,890	2,670	5,740	8,770
Crude Protein	61.6	144.7	173.0	495.9	920.0
Phosphoric Oxide	3.4	5.9	14.0	30.9	43.5
Lime	4.2	12.5	12.7	27.8	37.4

* Results of Marandellas experiments in 1947/48: totals for two cuts per season; the herbs are largely unpalatable (11).

The question will be asked: Is the use of such large amounts of fertilisers economic? It is attempted to answer this question on the basis of the data presented in the foregoing sections.

TABLE XI.

Economics of Fertiliser Applications.

Treatment	NP	N_2P	N_4P	N_6P	N_8P
GROSS RETURN DUE TO FERTILISER TREATMENT					
Lb. Protein per Acre*	70	111	323	496	747
Monetary Value†	38/-	60/-	174/-	268/-	403/-
FERTILISER COSTS PER ACRE					
Superphosphate	24/-	24/-	24/-	24/-	24/-
Ammonium Sulphate	29/-	58/-	116/-	174/-	232/-
Totals	53/-	82/-	140/-	198/-	256/-
VALUE OF NET GAINS PER ACRE					
Loss (−) or Profit (+)	−15/-	−22/-	+34/-	+70/-	+147/-

* Protein yield of respective treatment minus protein yield of unfertilised control.

† 100 lb. of protein valued at 54/-.

In Table XI the costs and returns for the various fertiliser treatments are shown (excluding the phosphate-only treatment, which resulted in a clear loss economically, since it did not produce any yield increase). The fertiliser costs are based on the prices ruling in 1950, f.o.r., Salisbury, plus an additional 30s. per ton to cover expenses of railage, transport to and on the farm, and spreading. No allowance has been made for the costs of establishing the pasture, management, fencing, etc. These expenses would be roughly the same for all treatments, particularly if the pasture is used for grazing only, though when cut for hay the expenses will increase with the bulk of hay to be handled. The return from the plots was calculated from the yields of protein in excess of the unfertilised control. The monetary equivalent of the protein yields was assessed in the following way: Of the existing commercial roughages, bean hay is the one most comparable to Star grass hay. Bean hay is sold at a producer price of £6 10s. (and more) per ton. Since it contains as an average 12% of crude protein, 100 lb. of protein in the form of bean hay cost 54s., and this figure was used to calculate the monetary value of the protein yields in Table XI.† While no exact comparative data regarding the relative feeding values of the protein in Star grass and bean hay are available, it may be mentioned that French in Tanganyika (1) found that the digestibility coefficient of Star grass protein was 70-75%, which is of the same magnitude as that of legume hay (3). From the results given in Table XI it appears that the use of 100 and 200 lb. of ammonium sulphate in combination with 200 lb. of superphosphate per acre resulted in a financial loss. However, larger quantities of ammonium sulphate produced significant gains which increased with the amount of nitrogen applied. Since there was no diminishing of returns, it is likely that larger applications would have given even bigger returns.

It is emphasised that these figures are presented with due reservation, since they are derived from a small-scale experiment and the results of one season only. More work, using large-scale grazing experiments, in which returns will be measured in terms of beef or milk production, will be necessary to substantiate the present conclusions. It is, however, considered that with proper grazing management even better results will be obtained, since the grazing animal returns a large proportion of the removed nutrients to the pasture in the form of manure. In addition, the beneficial effect that such grass leys have on subsequent agricultural crops through the building-up of soil structure, organic matter and fertility must be considered.

SUMMARY.

This paper reports the results of certain investigations, carried out at the Marandellas Grassland Research Station and dealing with the seasonal growth and chemical changes in Star grass (*Cynodon plectostachyum Pilger*), and the effect of different amounts of ammonium sulphate on a Star grass pasture.

† 100 lb. of protein in the form of oil cake cost approximately 50s. at the present time.

In protected Star grass (Strains No. 2 and No. 4) the percentages of protein, acid-soluble ash, phosphoric oxide and potash decreased with the advance of the season, while the lime content remained more or less constant or showed an increase towards the end of the season. The protein content was high in the young grass but dropped rapidly during the period of maximum growth; applications of nitrogenous fertiliser and repeated cutting raised the protein content of the herbage. The phosphorus and lime content of the two strains of Star grass was at all stages of growth superior to that of indigenous veld grasses.

A fertiliser experiment was laid out on an established pasture of Star grass No. 2, in which amounts of ammonium sulphate varying from 100 to 800 lb. per acre were applied annually, together with 200 lb. of superphosphate.

While phosphate alone had no effect on the yields, these increased markedly with increased applications of ammonium sulphate which also raised the protein content of the herbage and improved its palatibility.

The total yields of crude protein, phosphoric oxide and lime (in lb. per acre) greatly increased with the amount of ammonium sulphate applied. With 800 lb. of ammonium sulphate plus 200 lb. of superphosphate per acre, the yield of protein was five times, and that of phosphorus and lime three times, as high as without fertiliser treatment.

The results of this work indicate that well-fertilised Star grass pastures are vastly superior in productivity to ordinary veld, and calculations are presented which indicate that the use of larger quantities of ammonium sulphate (400 lb. per acre and more) is economic.

The acidity of the soil was found to increase with the quantity of ammonium sulphate applied, and the use of agricultural lime (in conjunction with ammonium sulphate) or of other nitrogenous fertilisers in place of ammonium sulphate is recommended on acid soils of this type.

ACKNOWLEDGMENTS.

Thanks are due to Mr. J. M. Rattray, Senior Pasture Research Officer, Marandellas Grassland Research Station, and his Staff for help and co-operation in the field work.

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Southern Rhodesia Veterinary Report

FOR THE MONTH OF JUNE, 1950.

General.

Grazing deteriorated in all Districts. With the exception of the Melsetter District water was scarce and drought conditions prevailed in many areas. Cattle remained in fair condition.

Tick Life.

With the exception of the Umtali and Fort Victoria Districts, tick life was reported to be very active. The following quarantine notices were issued during the month: Salisbury 7, Bulawayo 16, Gwelo 14.

Scheduled Diseases.

1. African Coast Fever: Nil.

2. Theileriosis: Reported in the Salisbury and Melsetter Districts.

3. Anthrax: Nil.

4. Foot and Mouth Disease: A full cordon was established on the Bechuanaland/Southern Rhodesia Border, and four officials of the Department were temporarily seconded to the Bechuanaland Protectorate, to assist with the outbreak of Foot and Mouth Disease there.

   An outbreak was diagnosed and confirmed on Triangle Sugar Estate in the Fort Victoria District. Extensive inspections were made, a cordon placed round the Estate, and all cattle therein inoculated.

5. Glanders or Farcy: Nil.

6. Heartwater: Seven deaths were reported in the Bulawayo District.

7. Lungsickness (Contagious Pleuro Pneumonia of Cattle): Nil.

8. Mange in Horses, Mules, Donkeys and Camels: Nil.

9. Pyaemia or Epizootic Lymphangitis: Nil.

10. Redwater: Cases were reported in all Districts with the exception of Fort Victoria District.

11. Rinderpest: Nil.

12. Swine Erysipelas: Nil.

13. Swine Fever: Nil.

14. Quarter Evil: Cases were reported in all Districts.

15. Tuberculosis: In the Bulawayo District a Friesland Bull imported from the Union of South Africa gave a positive reaction to the tuberculin test; 96 head from Liebigs Ranch, West Nicholson, were found to be infected. In the Umtali District reactors to a test made were isolated for subsequent disposal as slaughter stock.

16. Scab: Nil.

17. Rabies: Nil.

18. Senkobo Disease: Nil.

19. Trypanosomiasis: Occurred in the Mkoto and Urungwe Reserves in the Salisbury District. It is again prevalent in the Chipinga District.

20. Contagious Epididymitis and Vaginitis (Epi-Vag): In the Salisbury District 19 new centres were confirmed. 776 Bulls on 314 farms were inspected, of which 22 Bulls were found to be infected and 8 Bulls under further observation. One farm was released from quarantine.

In the Bulawayo District one Bull was found to be infected and two Bulls are under further observation.

A new centre was confirmed at Umvuma in the Gwelo District, where 5 Bulls were found to be infected.

21. Lumpy Skin Disease: A few light cases noted in the Bulawayo and Gwelo Districts.

22. Contagious Abortion: Numerous cases occurred in the Bulawayo District.

Scheduled Poultry Diseases.

23. Spirochaetosis: Nil.

24. Coccidiosis: One case occurred in the Salisbury District.

25. Fowl Typhoid: Nil.

26. Bacillary White Diarrhoea: One case was confirmed in the Umtali District.

27. Tuberculosis: Nil.

28. Chicken Pox and Roup: Nil.

Other Diseases.

29. Gallsickness: Reported in the Salisbury, Bulawayo, Umtali, Gwelo and Melsetter Districts.

30. Paratyphoid: Nil.

31. Horse Sickness: One case reported in the Salisbury and in the Gwelo Districts.

32. Geilsieke: Nil.

33. Biliary: Nil.

34. Sweating Sickness: Six cases reported in the Bulawayo District.

35. Opthalmia: Is prevalent in the Fort Victoria District with a few cases in the remaining Districts.

36. Screw Worm: A few cases occurred in all Districts.

37. Coccidiosis: Nil.

38. Spirochactosis: Nil.

39. Internal Parasitis: Still responsible for numerous deaths in the Melsetter District.

Poisoning.

40. Veld Poisoning: Ten deaths were reported in the Bulawayo District and eight deaths in the Umtali District. Cases also occurred in the Gwelo and Melsetter Districts.

41. Mineral Poisoning: Deaths from Arsenical Poisoning were reported in the following Districts: Bulawayo 25; Umtali 2; Melsetter 7. There were 3 cases of suspected Nitrate Poisoning in the Salisbury District and 5 cases of Cyanide Poisoning in the Bulawayo District.

Mallein Testing: 120 Horses, 7 Mules and 45 Donkeys tested, with negative results.

Tuberculin Testing: 8 Bulls, 44 Cows, 42 Heifers and 8 Yearlings tested, with 1 reactor which was slaughtered.

IMPORTATION.

Union of South Africa: 64 Geldings, 36 Horses and Mares, 7 Mules, 102 Cows and Calves (Breed), and 12 Bulls (Breed).

EXPORTATION.

Union of South Africa: 4 Geldings and 3 Horses and Mares.

Portuguese East Africa: 10 Oxen (Slaughter), and 7 Cows and Calves (Breed).

Northern Rhodesia: 4 Pigs (Breed), 8 Geldings, 1 Bull (Breed), 11 Cows and Calves (Breed), and 45 Donkeys.

Nyasaland: 9 Cows and Calves (Breed).

EXPORTATION—MISCELLANEOUS.

Union of South Africa: 11,942 lbs. Sausage Casings.

Northern Rhodesia: 10,641 lbs. ¾ Sides, 6,853 lbs. Middles, 52 lbs. Rolls, 1,278 lbs. Ham, 1,345 lbs. Gammon, 7 lbs. Pie Hams, 2,775 Cooked Shoulders, 1,144 lbs. Sliced Shoulders and 4,300 Smalls.

Belgian Congo: 1,150 lbs. Gammon and 382 lbs. Cooked Choulders.

Bechuanaland Protectorate: 37 lbs. Middles, 82 lbs. Cooked Shoulders, and 180 lbs. Sliced Shoulders.

Meat Products from Liebigs (Rhodesia) Ltd., West Nicholson:—

Union of South Africa: 66,000 lbs. Corned Beef, 2,250 lbs. Oxford Sausages, 1,575 lbs. Liver Roll, 7,200 lbs. Steak and Kidney, 15,600 lbs. Braised Steak, 16,800 lbs. Braised Steak and Onion, 3,570 lbs. Potted Meat, 500 lbs. Beef Dripping.

J. E. ADAMSON,
Director of Veterinary Services.

JULY, 1950

General. The scarcity of water continued with resulting deterioration in grazing. Cattle were in fair condition.

Tick Life. Tick life was reduced in activity. The following quarantine notices were issued during the month: Salisbury 4, Bulawayo 12, Gwelo 4.

SCHEDULED DISEASES.

1. **African Coast Fever.**—Nil.

2. **Theileriosis.**—One new centre in the Salisbury District. All farms in the Melsetter District released from quarantine.

3. **Anthrax.**—Reported in the Bulawayo District.

4. **Foot and Mouth Disease.**—Inspections were maintained on the Bechuanaland/Southern Rhodesia border. Further cases were reported in areas adjacent to the original outbreak in the Fort Victoria District and the cordons were suitably extended.

5. **Glanders or Farcy.**—Nil.

6. **Heartwater.**—Reported in the Bulawayo District.

7. **Lungsickness** (Contagious Pleuro Pneumonia of Cattle).—Nil.

8. **Mange in Horses, Mules, Donkeys and Camels.**—Nil.

9. **Pyaemia or Epizootic Lymphangitis.**—Nil.

10. **Piroplasmosis.**—Confirmed on seven farms in the Salisbury District. Nine cases were reported in the Umtali District, and four cases in the Melsetter District.

11. **Rinderpest.**—Nil.

12. **Swine Erysipelas.**—Nil.

13. **Swine Fever.**—Nil.

14. **Quarter Evil.**—Cases were reported in all Districts with the exception of Fort Victoria and Melsetter Districts.

15. **Tuberculosis.** Reported at West Nicholson in the Bulawayo District. Nine cows imported from the Union of South Africa reacted positively to the test. An eradication scheme is in operation at Umtali.

16. **Scab.** Reported in two sheep in the Bulawayo District.

17. **Rabies.**—Patrols were instituted in the Beit Bridge area on the Southern Rhodesia/Union of South Africa border.

18. **Senkobo Disease.**—Nil.

19. **Trypanosomiasis.**—Cases were confirmed in the Mtoko and Urungwe Reserves in the Salisbury District, and two cases in the Chipinga District.

20. **Contagious Epididymitis and Vaginitis** (Epi-Vag).—In the Salisbury District three new centres were confirmed and two farms released from quarantine. In the Gwelo District two new centres were confirmed. Cases were also reported at West Nicholson in the Bulawayo District.

21. **Lumpy Skin Disease.**—Nil.

22. **Contagious Abortion.**—Reported in the Salisbury and Bulawayo Districts.

SCHEDULED POULTRY DISEASES.

23. **Spirochactosis.**—Nil.

24. **Coccidiosis.**—One case occurred in the Salisbury District.

25. **Fowl Typhoid.**—An outbreak with heavy mortality was reported in the Umtali District.

26. **Bacillary White Diarrhoea.**—Nil.

27. **Tuberculosis.**—Nil.

28. **Chicken Pox and Roup.**—Nil.

OTHER DISEASES.

29. **Gallsickness.**—Cases were reported in the following Districts: Salisbury 16, Bulawayo 2, Gwelo 3, Melsetter 1.

30. **Paratyphoid.**—Nil.

31. **Horse Sickness.**—One death was reported in the Bulawayo District, and two deaths in the Gwelo District.

32. **Geilsieke.**—Nil.

33. **Biliary.**—Nil.

34. **Sweating Sickness.**—Nil.

35. **Opthalmia.**—Reported to be prevalent in the Salisbury, Bulawayo and Fort Victoria Districts with a few cases in the Umtali, Gwelo and Melsetter Districts.

36. **Screw Worm.**—A few cases occurred in the Salisbury, Umtali and Melsetter Districts.

37. **Coccidiosis.**—An outbreak in calves occurred in the Umtali District.

38. **Spirochactosis.**—Nil.

39. **Internal Parasitis.**—Causing losses in cattle in the Melsetter District. Heavy infestation was also reported in the Bulawayo District.

POISONING.

40. **Veld Poisoning.**—Was reported in the Salisbury, Bulawayo, Gwelo and Melsetter Districts.

41. **Mineral Poisoning.**—Cases of Arsenical poisoning were reported in the following Districts: Salisbury 13, Bulawayo 2, Umtali 7, Gwelo 7.

Mallein Testing.—64 horses tested with negative results.

Tuberculin Testing.—30 bulls, 28 cows and 40 heifers were tested. Four reactors which were slaughtered on the 17/7/50.

IMPORTATIONS.

Union of South Africa.—6 horses and mares, 34 geldings, 12 bulls (breed), 71 cows and calves (breed), 1 goat (breed).

United Kingdom.—1 bull (breed).

EXPORTATIONS.

Portuguese East Africa.—25 oxen (slt.), 2 bulls (breed), 23 cows and calves (breed), 3 trek oxen, 1 pig (breed).

Northern Rhodesia.—13 bulls (breed), 4 pigs (breed), 12 mules, 11 geldings.

Belgian Congo.—3 bulls (breed), 3 horses and mares, 21 geldings, 6 pigs (breed).

Union of South Africa.—1 horse and mare, 1 gelding.

EXPORTATIONS—MISCELLANEOUS.

Northern Rhodesia.—¾ sides, 9,278 lb.; middles, 6,866 lb.; rolls, 63; homs, 224 lb.; gammons, 1,956 lb.; cooked shoulder, 3,312 lb.; sliced shoulder, 1,779 lb.; smalls, 3,918 lb.

Bechuanaland Protectorate.—Cooked shoulder, 53 lb.; sliced bacon, 96 lb.; smalls, 368 lb.

Meat products from Liebigs (Rhodesia) Ltd., West Nicholson:—

Union of South Africa.—Potted meat, 5,400 lb.

Belgian Congo.—Corned beef, 66,360 lb.; ox tail in jelly, 24 lb.

Portuguese East Africa.—Corned beef, 2,700 lb.; Vienna sausages, 300 lb.

J. T. ADAMSON,
Director of Veterinary Services.

Rhodesian Milk Records

OFFICIAL MILK RECORDS.

Name of Cow.	*Breed.*	*Age.*	*Milk in lbs.*	*B. Fat in lbs.*	*Average % B. Fat.*	*No. of Days.*	*Name and Address of Owner.*
Inverleith Star Dawn	Jersey	22 months	4795.50	243.92	5.09	300	M. W. Burras, Hertford Farm, Box 443, Bulawayo.
Meadow's Wonderful Winsome	Jersey	Sen. 3 years	7011.00	377.42	5.38	290	
Surguy Jane	Jersey	2 years	7249.00	338.17	4.67	300	
Abbotsford Lindberg Geluk	Friesland	2 years	4351.00	162.77	3.74	300	E. W. Butler, "Woodlands," P.O. Shamva
Colonies Plaats Amrolla's Grietje III	Friesland	Mature	9520.00	353.20	3.71	300	
Kingswood Dieukmar Ceres VI	Friesland	2 years	7745.50	263.00	3.40	258	Frogmore Estates, Ltd., M'sonneddi.
Dalham Clarice	Jersey	2 years	5295.00	261.08	4.93	300	F. Gebbie, South Lawn, P.B. 42, Marandellas.
Dalham Dot	Jersey	Jun. 3 years	5629.00	282.70	5.02	300	
Fawkham Olive Oil	Jersey	2 years	7055.50	369.17	5.22	297	
Dalham Isabella	Jersey	Sen. 4 years	7979.50	385.17	4.82	300	S. Gelman, 27, Baxendale St., Bulawayo.
Dalham Lena	Jersey	Sen. 4 years	8673.00	418.15	4.81	300	
Dalham Nina	Jersey	Sen. 4 years	6371.00	318.62	3.00	270	
Dalham Salandra	Jersey	Jun. 3 years	7984.50	374.04	4.68	300	
Dalham Selina	Jersey	Mature	7694.50	365.40	4.75	300	
Gondangdia Mangaria	Jersey	Jun. 3 years	3928.50	160.57	4.09	275	

Matopo Toss	Red Poll	Mature	8300.50	328.60	3.96	300	Government Experiment Station, P.B. 19K, Bulawayo.
Matopo Treasure	Red Poll	Mature	11173.80	398.84	3.57	300	
Matopo Unique	Red Poll	Sen. 4 years	12193.30	421.12	3.45	300	
Matopo Wren	Red Poll	Jun. 4 years	6844.60	230.62	3.37	266	
Matopo Vamp	Red Poll	Sen. 4 years	5111.60	207.20	4.05	300	
Albert Vale Bokwagen XVII	Friesland	Mature	12416.00	404.10	3.26	300	J. Jamieson, Criterion Farm, Box 217, Bulawayo.
Criterion Rotus's Spinnekop	Friesland	Mature	9169.00	330.68	3.61	300	
Criterion Susanna II	Friesland	2 years	10492.00	358.35	3.42	300	
Gouwsplant Jantje II	Friesland	Mature	13053.00	410.12	3.14	300	
Prinsloo Hanke	Friesland	Jun. 3 years	10392.00	355.13	3.42	300	
Prinsloo Sue	Friesland	Jun. 3 years	10408.00	369.43	3.55	300	
Azana's Amy	Jersey	Mature	7368.00	333.76	4.53	270	J. H. Keightley, Moorfields, Glendale.
Meadow's Gift IV	Jersey	Mature	5114.50	273.95	5.33	300	
Meadow's Pioneer Wallflower	Jersey	Mature	5949.00	412.44	6.93	300	
M'Sasa Jean	Jersey	2 years	2962.50	178.95	6.04	240	
Dirko Jong Kapok	Friesland	2 years	7373.10	277.84	3.77	300	A. L. Millar, Estes Park, P.B. 28A, Salisbury.
Dirko Lindberg Jong Doring IV	Friesland	2 years	5018.30	210.70	4.20	300	
Dirko Marie I	Friesland	2 years	6611.10	257.56	3.90	300	
Middeldam Gloria's Lass	Jersey	Jun. 3 years	5238.00	285.99	5.47	300	Mrs. E. L. Parkes, Box 159, Salisbury.
Middeldam Prim Sybil	Jersey	Mature	5252.00	290.24	5.52	300	
Neuwied Miranda	Jersey	Mature	7819.50	381.40	4.88	300	
Albertvale Bokwagon XVI	Friesland	Mature	5427.50	181.78	3.35	300	T. C. Pascoe, Crowborough Estate, P.O. Box 1253, Salisbury.
Crowborough Charlotte	Friesland	Sen. 3 years	8069.00	287.82	3.57	300	
Crowborough Clara	Friesland	Jun. 4 years	7502.00	246.74	3.29	300	

OFFICIAL MILK RECORDS (Continued).

Name of Cow.	*Breed.*	*Age.*	*Milk in lbs.*	*B. Fat in lbs.*	*Average % B. Fat.*	*No. of Days.*	*Name and Address of Owner.*
Crowborough Clarabel	Friesland	2 years	2910.00	108.21	3.72	300	T. C. Pascoe, Crowborough Estate, Box 1253, Salisbury.
Crowborough Daisy	Friesland	Jun. 3 years	6771.00	239.55	3.54	300	
Mitchlin Beauty's Cecilia	Friesland	Sen. 3 years	6858.00	252.56	3.68	300	D. Robertson Synd., Ltd., Hilda's Kraal, P.B. 158R, Bulawayo.
Mitchlin Dignity C. II	Friesland	Mature	8162.50	255.10	3.13	300	
Mitchlin Dignity C. III	Friesland	Jun. 4 years	8010.50	241.67	3.07	300	
Mitchlin Liberty	Friesland	Mature	10018.00	349.80	3.49	300	
Mitchlin Lobelia	Friesland	Mature	9313.00	278.25	2.99	265	
Mitchlin Lobelia's Bess	Friesland	Mature	11155.00	369.17	3.31	300	
Mitchlin Winona	Friesland	Mature	10536.00	364.19	3.46	300	
Whinburn Aconite	Friesland	Mature	14434.10	520.24	3.60	300	Major R. R. Sharp, Whiuburn, Redbank, Bulawayo.
Whinburn Daffodil	Friesland	Jun. 3 years	8729.60	275.76	3.16	300	
Whinburn Damask	Friesland	2 years	6750.90	218.42	3.24	300	
Whinburn Dream	Friesland	2 years	8367.20	272.24	3.25	300	
Whinburn Dumpling	Friesland	2 years	5470.20	193.94	3.55	300	
Whinburn Duty	Friesland	2 years	8210.60	273.25	3.33	300	
Whinburn Canny	Friesland	Sen. 3 years	5252.90	202.20	3.85	251	
Whinburn Cowslip	Friesland	Jun. 4 years	5981.20	192.93	3.26	300	
Whinburn Polonaise	Friesland	Mature	13857.70	504.23	3.72	300	
Cambraie's Zinnia	Jersey	Sen. 4 years	7239.00	368.49	5.09	300	C. G. Tracey, Handley Cross, P.B. Gatooma.

Bonny	G. Friesland	2 years	6506.00	231.85	3.56	282	D. A. Allan, "Pendennis" Farm, P.O. Avondale.
Alexis	G. Friesland	3 years	8835.40	307.52	3.49	259	B. M. Atkinson, P.O. Box 1404, Salisbury.
Kipsand	G. Friesland	Mature	7286.40	245.45	3.38	300	
Lily	G. Jersey	Mature	8113.20	329.96	4.06	300	
Margaret	G. Friesland	3 years	7912.70	280.16	3.54	300	
Queenie	G. Friesland	3 years	7065.50	247.57	3.49	300	
Blossom	G. Friesland	Mature	7060.00	242.53	3.44	254	R. A. Ballantyne, P.O. Box 801, Salisbury.
Carol	G. Friesland	Mature	6119.00	227.16	3.71	236	
Thisbe	G. Friesland	3 years	5533.00	240.49	4.35	300	
Victoria	G. Friesland	Mature	6872.00	228.47	3.32	300	
Pride	G. Friesland	Mature	5900.00	227.04	3.85	300	N. G. Barrett, Gavenny, P.O. Box 38, Rusape.
Charlotte II	G. Shorthorn	4 years	5516.50	252.90	4.58	300	F. J. Barry, Umtassa, Box 209, Umtali.
Marina	G. Shorthorn	3 years	5492.50	263.60	4.80	300	
Zoolass II	G. Shorthorn	Mature	6691.50	294.15	4.40	300	
Joy II	G. Shorthorn	Mature	5676.10	236.94	4.16	300	J. H. Barry, En Avant, P.B. Umtali.
Chemate II	G. Friesland	3 years	6567.70	250.92	3.82	300	J. A. Baxter, Box 1368, Salisbury.
Dick	G. Friesland	Mature	7193.00	234.97	3.27	300	
France	G. Friesland	Mature	6198.10	227.73	3.67	300	
Margaret	G. Friesland	4 years	7432.00	260.43	3.50	238	
Soap Suds	G. Friesland	Mature	7192.30	251.78	3.50	300	
Sixpence	G. Friesland	Mature	8394.40	344.78	4.11	300	
Sydney	G. Friesland	Mature	7953.80	259.26	3.26	300	
Cleo	G. Friesland	2 years	7606.00	289.13	3.80	300	A. Berry, "Lendy," Marandellas.
Katie	G. Friesland	2 years	8193.00	275.39	3.36	300	
Market	G. Friesland	Mature	5645.00	236.93	4.20	252	
D. 69	G. Friesland	Mature	7747.20	276.01	3.56	300	A. L. Bickle, P.O. Box 595, Bulawayo.
Adelaide	G. Guernsey	Mature	7886.70	326.14	4.14	300	W. C. Boyce, "Omeath," P.O. M'sonneddi.
Bella	G. Guernsey	Mature	5923.60	251.10	4.24	300	

SEMI-OFFICIAL—(Continued).

Name of Cow.	*Breed.*	*Age.*	*Milk in lbs.*	*B. Fat in lbs.*	*Average % B. Fat.*	*No. of Days.*	*Name and Address of Owner.*
Grove Park Helen	G. Shorthorn	Mature	7836.00	268.55	3.43	300	Bradley Bros., P.O. Box 699, Bulawayo.
Grove Park Polane	G. Friesland	Mature	9171.00	285.31	3.11	300	
Beauty	G. Friesland	Mature	6069.00	253.99	4.19	300	Miss N. Brereton, Coolmoreen, Gwelo.
Lulu	G. Friesland	2 years	8088.50	280.59	3.47	300	B.S.A. Co. Mazoe Citrus Estate, Mazoe.
No. 18	G. Friesland	Mature	6449.00	232.65	3.61	278	Col. P. A. Brooke, "Borrowdale-Homestead," P.O. Box 1690, Salisbury.
No. 84	G. Friesland	3 years	6364.80	234.60	3.69	300	Brucehame Dairy, Box 21, Fort Victoria.
Laurie	G. Friesland	Mature	9387.00	324.50	3.46	300	M. W. Burras, Box 443, Bulawayo.
Brenda	G. Ayrshire	Mature	6284.50	225.13	3.58	300	L. E. O. Cary, Clovelly, P.O. Trelawney.
Fresia	G. Ayrshire	Mature	8636.00	326.03	3.77	300	
Ruby	G. Ayrshire	Mature	6193.50	230.76	3.73	286	
Anne	G. Friesland	Mature	9065.00	308.60	3.40	300	Mrs. O. L. Christo, Box 110, Gwelo.
Spitfire	G. Friesland	Mature	6910.00	243.32	3.52	274	
Agnes	G. Friesland	2 years	9683.30	289.96	3.00	300	Mrs. L. Jackson Clarke, Kingston Dairy, Gwelo.
Diana	G. Friesland	2 years	6326.80	251.39	3.97	182	
Dolly	G. Friesland	2 years	8290.70	331.11	4.00	300	
Midget	G. Friesland	Mature	12606.00	439.02	3.48	300	
Molly	G. Ayrshire	2 years	10609.50	404.52	3.81	300	
Whiskey	G. Ayrshire	4 years	9763.50	353.88	3.62	300	
No. 23	G. Friesland	Mature	8679.00	300.93	3.47	300	Cross & Son, P.B. T.208, Bulawayo.
No. 120	G. Friesland	3 years	6970.00	236.63	3.39	300	

Ann	G. Friesland	3 years	7223.90	266.09	3.70	300	J. V. Danckwerts, P.O. Box 989, Salisbury.
Audrey	G. Friesland	2 years	6671.70	269.79	4.04	300	
Brantyre	G. Friesland	4 years	9934.60	341.30	3.44	273	
Libby	G. Friesland	2 years	7159.40	251.80	3.50	300	
Lorraine	G. Friesland	2 years	7755.50	265.98	3.43	300	
Margot	G. Friesland	4 years	7492.60	279.32	3.73	300	
Maureen	G. Friesland	4 years	6161.20	226.05	3.67	300	
Munga Munga	G. Friesland	Mature	9400.20	364 49	3.77	300	
Jane	G. Friesland	2 years	6342.70	248.17	3.91	300	
Sylvia	G. Friesland	2 years	7072.30	265.95	3.76	300	
No. 22	G. Guernsey	3 years	5402.00	247.04	4.57	300	B. St. J. D. Downes, Safago Farm, P.B. Gwelo.
No. 333	G. Guernsey	Mature	8287.40	283.54	3.42	300	
No. 387	G. Guernsey	Mature	7219.30	310.21	4.24	300	
No. 455	G. Guernsey	Mature	6817.70	328.88	4.81	300	
No. 457	G. Guernsey	Mature	7242.50	287.96	3.98	300	
No. 469	G. Guernsey	Mature	7379.00	328.60	4.45	300	
Sheelah	G. Friesland	3 years	6699.50	272.40	4.06	258	Mrs. D. M. Edwards, Box 11, Eiffel Flats
No. 8	G. Friesland	Mature	6284.00	243.61	3.87	300	
Queen Alexandra	G. Friesland	4 years	8977.00	344.00	3.83	300	R. I. Edwards, Box 25, Chipinga.
No. 291	G. Friesland	3 years	6986.00	254.93	3.69	275	R. le S. Fischer, Wakefield, Headlands.
No. 51	G. Friesland	Mature	7547.00	292.78	3.88	300	
No. 72	G. Friesland	Mature	8549.00	338.40	3.96	300	
No. 88	G. Friesland	Mature	7539.00	289.89	3.85	300	
No. 160	G. Friesland	Mature	7311.00	254 29	3.48	300	
No. 283	G. Friesland	3 years	6869.00	242.89	3.54	287	
No. 5	G. Friesland	3 years	10685.00	361.57	3.39	300	Mrs. H. C. Fischer, Olivia Farm, Headlands.
No. 17	G. Friesland	3 years	9693.00	309.62	3.19	300	
No. 59	G. Friesland	Mature	11068.00	393.73	3.56	300	
No. 130	G. Friesland	Mature	9657.00	372.77	3.86	300	
No. 150	G. Friesland	4 years	9343.50	345.01	3.69	300	
No. 239	G. Friesland	Mature	8336.50	256.16	3.07	292	
No. 32A	G. Friesland	4 years	7781.00	305.56	3.93	300	W. F. Fischer, Coldstream Dairy, Headlands.
No. 37A	G. Friesland	4 years	8206.00	268.66	3.27	300	
No. 69A	G. Friesland	3 years	6596.00	250.98	3.81	300	
No. 355	G. Friesland	Mature	7524.00	259.02	3.44	300	
No. 412	G. Friesland	Mature	7125.00	293.50	4.12	300	
No. 446	G. Friesland	4 years	6010.00	233.51	3.89	300	
No. 463	G. Friesland	Mature	6406.00	248.27	3.87	300	

SEMI-OFFICIAL—(Continued)

Name of Cow.	*Breed.*	*Age.*	*Milk in lbs.*	*B. Fat in lbs.*	*Average % B. Fat.*	*No. of Days.*	*Name and Address of Owner.*
No. 475	G. Friesland	Mature	6196.00	278.15	4.49	286	W. F. Fischer, Coldstream Dairy, Headlands.
No. 561	G. Friesland	Mature	7235.00	258.42	3.57	300	
No. 570	G. Friesland	4 years	6150.00	259.23	4.21	300	
No. 593	G. Friesland	4 years	5789.00	250.45	4.32	300	
No. 597	G. Friesland	4 years	6717.00	247.16	3.68	300	
Gilston Constance	P.B. Red Poll	Mature	5991.00	228.59	3.81	300	G. N. Fleming, Box 688, Salisbury.
Flower	G. Common	2 years	6078.00	240.28	3.95	300	F. W. Forrester, Wilton, Marandellas.
Josephine	G. Guernsey	Mature	8921.00	330.41	3.82	300	
Pyjamas II	G. Friesland	4 years	6268.00	232.80	3.71	300	
Gwenam	G. Friesland	Mature	7156.90	243.60	3.40	300	P. Freeland, Lingfield, Gwelo.
Julia	G. Friesland	Mature	9357.10	326.79	3.49	300	
Kanda	G. Friesland	Mature	8186.50	286.77	3.51	300	
Skokie	G. Friesland	4 years	6526.20	229.60	3.52	300	
Vingia	G. Friesland	Mature	8039.80	314.17	3.91	300	
No. 2	G. Friesland	Mature	6797.20	235.24	3.46	300	
No. 25	G. Friesland	Mature	6842.20	274.50	4.01	300	
No. 28	G. Friesland	4 years	7770.40	250.09	3.22	300	
No. A.96	G. Friesland	Mature	7330.20	272.91	3.72	264	
No. 6	G. Friesland	Mature	12432.50	398.74	3.21	300	S. Gelman, 27, Baxendale Street, Bulawayo.
Flo	G. Aberdeen-Angus	Mature	8048.00	345.51	4.29	296	Hon. H. V. Gibbs, P.B. 52L, Bulawayo.
Hane	G. Friesland	Mature	9639.00	347.50	3.61	300	
Mary	G. Friesland	Mature	9166.00	354.10	3.83	300	
Poppy	G. Friesland	4 years	8938.00	336.91	3.77	300	
Elsa	G. Friesland	3 years	5375.00	232.85	4.33	300	Mrs. P. Gordon Lennox, "Rakodzi," Marandellas.
No. 113	G. Friesland	Mature	9590.50	307.93	3.21	271	Government Farm, Gwebi, P.B. 76B, Salisbury.

Barlow's Vergelegen Jill	P.B. Jersey	4 years	5535.00	350.52	6.33	300	Government Experimental Farm, Karoi.
Myrtle	G. Jersey	3 years	5201.50	264.03	5.07	300	
No. 42	G. Friesland	Mature	16130.00	499.59	3.10	300	Grasslands Experiment Stn., Marandellas
No. 57	G. Friesland	Mature	12005.00	453.90	3.78	300	
No. 79	G. Friesland	Mature	9376.00	388.94	4.15	271	
Pinafore	G. Friesland	2 years	5557.90	225.19	4.05	282	E. E. C. Green, Mutzarara, Melsetter.
Fay	G. Guernsey	Mature	5829.70	236.63	4.06	300	D. A. Harley, Harleyton, P.O. Beatrice.
Lena	G. Friesland	Mature	7067.70	252.19	3.56	300	P.O. Beatrice.
Maud	G. Guernsey	Mature	5891.60	258.66	4.39	300	
Phyllis	G. Guernsey	Mature	6696.30	245.05	3.66	300	
Queenie II	G. Guernsey	Mature	6171.20	242.90	3.94	300	
Sarah	G. Guernsey	Mature	7407.40	306.93	4.14	300	
Valerie	G. Guernsey	Mature	5349.00	238.88	4.47	286	
Fidget	G. Friesland	Mature	7161.00	246.69	3.44	300	D. J. Huddy, Box 718, Salisbury.
Lulu	G. Friesland	Mature	8719.50	287.23	3.29	300	
Matilda	G. Friesland	Mature	5955.00	249.37	4.19	227	
Mattie	G. Friesland	Mature	6866.00	254.14	3.70	279	
Rosella	G. Friesland	Mature	9280.50	305.60	3.29	254	
No. 67	G. Friesland	Mature	6035.50	243.20	4.03	237	
Manwere	G. Friesland	Mature	6904.40	250.43	3.63	300	L. Huddy, Box 924, Salisbury.
Rose	G. Guernsey	Mature	10022.50	339.26	3.38	300	
Brenda	G. Guernsey	Mature	7473.00	278.46	3.73	297	Mrs. M. R. Huddy, P.O. Box 899,
Elsie	G. Guernsey	Mature	5841.50	256.98	4.40	300	Salisbury
Gillia	G. Jersey	3 years	7395.00	373.82	5.04	296	J. A. G. Hughes, Bains Hope, P.O.
Reno	G. Friesland	Mature	12112.00	407.78	3.36	300	Melfort.
J.25 1	G. Friesland	Mature	11988.00	384.80	3.21	300	J. Jamieson, Box 217, Bulawayo.
No. 15A	G. Friesland	Mature	8910.00	302.69	3.40	300	D. S. Kabot, Box 261, Bulawayo.
No. 29A	G. Friesland	4 years	7908.00	273.26	3.46	232	
No. 36	G. Friesland	Mature	11159.00	384.78	3.45	300	
No. 37	G. Friesland	Mature	11276.00	367.57	3.26	300	
No. 38A	G. Friesland	3 years	10300.00	441.43	4.29	300	
No. 49	G. Friesland	Mature	7127.00	225.62	3.15	251	
No. 59	G. Friesland	Mature	7921.00	287.25	3.63	242	

SEMI-OFFICIAL—(Continued).

Name of Cow.	*Breed.*	*Age.*	*Milk in lbs.*	*B. Fat in lbs.*	*Average % B. Fat.*	*No. of Days.*	*Name and Address of Owner.*
K.19	G. Friesland	Mature	9973.70	331.95	3.33	300	B. H. Kew, Box 972, Bulawayo.
K.32	G. Friesland	Mature	7609.90	295.02	3.88	300	
K.35	G. Friesland	Mature	8937.30	337.09	3.77	300	
K.50	G. Friesland	4 years	9348.60	372.05	3.98	300	
Jessie	G. Guernsey	3 years	5321.70	229.79	4.32	300	J. A. G. Kirstein, P.O. Box 199, Gwelo.
Lucy	G. Guernsey	3 years	5360.80	248.66	4.64	300	
Mof	G. Guernsey	3 years	5591.80	235.80	4.22	300	
Bulawayo	G. Guernsey	4 years	5640.80	263.16	4.68	300	
Susie	G. Guernsey	Mature	5899.40	245.34	4.16	300	
Nancy	G. Friesland	Mature	6894.00	251.89	3.65	300	J. N. L. MacIlwaine, Box 23, Marandellas.
Whinburn Balsam	P.B. Friesland	Mature	6759.00	275.78	4.08	289	
Howie's Dainty X	P.B. Ayrshire	3 years	7361.00	254.60	3.46	300	J. MacIntyre, Box 58, Shamva.
Betty	G. Friesland	Mature	7615.50	255.14	3.35	300	D. W. Marshall, Alderbury, Box 164, Umtali.
Clover	G. Friesland	Mature	7117.50	242.70	3.41	300	
Lulu	G. Friesland	4 years	6806.90	227.14	3.34	286	
Emma	G. Friesland	Mature	6603.20	234.82	3.56	300	A. R. Matches, P.O. Box 64, Salisbury.
George	G. Friesland	2 years	5810.60	230.94	3.97	300	
May	G. Friesland	Mature	9981.70	353.84	3.54	300	
Paddy	G. Friesland	Mature	6004.30	253.74	4.23	300	
Minhinick Aurora	P.B. Friesland	3 years	7453.00	257.44	3.45	300	J. U. McCay, P.B. J181, Bulawayo.
Thibet Park Martyn's Helene	P.B. Friesland	Mature	8769.00	310.94	3.55	294	
No. 118	G. Friesland	Mature	10438.00	318.06	3.05	300	
No. 142	G. Friesland	4 years	6721.00	232.87	3.46	300	
No. 145	G. Friesland	4 years	6215.00	237.37	3.82	300	
No. 149	G. Friesland	4 years	6271.00	242.95	3.87	300	
No. 165	G. Friesland	3 years	6858.00	233.36	3.40	300	
Bluey	G. Friesland	Mature	7098.30	254.76	3.59	284	J. H. McLean, Box 161, Gwelo.
Betty	G. Friesland	Mature	5473.60	245.36	4.48	296	
Kirstein	G. Friesland	Mature	7070.60	244.94	3.46	292	
Moff	G. Friesland	Mature	7437.20	251.92	3.39	268	
Rhona	G. Shorthorn	Mature	6516.20	269.31	4.13	288	

Baby	G. Friesland	Mature	6548.50	289.67	4.42	300	L. McLean, Divide, Gwelo.
Makorsi	G. Friesland	Mature	5664.50	239.02	4.22	221	
Rita	G. Friesland	Mature	7696.50	244.21	3.17	300	
No. 64	G. Guernsey	4 years	7407.50	282.74	3.82	300	
No. 68	G. Friesland	3 years	8178.00	281.34	3.44	300	
No. 4/9	P.B. Friesland	Mature	8322.00	254.21	3.05	300	Meikles Trust & Invest. Co., Ltd., Leachdale Farm, Shangani.
No. G.12/3	G. Friesland	Mature	8220.00	272.39	3.31	300	
G.16/3	G. Friesland	Mature	8731.00	298.81	3.40	300	
Bessie	G. Ayrshire	4 years	7310.00	259.89	3.56	300	R. L. Moffat, Ormiston, Shangani.
Dorothea	G. Ayrshire	4 years	6541.00	269.49	4.12	300	
Eve	G. Ayrshire	4 years	7289.00	295.83	4.06	300	
Gracie	G. Ayrshire	4 years	6647.00	266.39	4.01	300	
Lassie	G. Ayrshire	4 years	6360.00	287.66	4.52	300	
Ursula	G. Ayrshire	4 years	4315.00	238.87	5.54	300	Com. E. L. Morant, Box 741, Salisbury.
Princess Marina	G. Friesland	Mature	6474.00	269.22	4.16	266	G. R. Morris, P.O. Box 1040, Salisbury.
No. 148	G. Friesland	Mature	6764.00	233.38	3.45	293	F. B. Morrisby, Box 36, Gwelo.
Brakfontein							
Witkwas XIX	P.B. Friesland	Mature	11129.00	401.38	3.61	300	K. Norvall, Box 637, Bulawayo.
Dulcie II	G. Friesland	Mature	6825.00	230.43	3.38	300	
Mahlmick Urchin	P.B. Friesland	2 years	9194.00	307.50	3.34	300	
Una I	G. Friesland	4 years	7129.00	234.53	3.29	277	
No. 11	G. Friesland	Mature	6098.00	225.06	3.69	268	P. Odendaal, Whittington, Box 4, Chipinga.
No. 38	G. Friesland	Mature	9380.00	317.40	3.38	280	
No. 78	G. Friesland	4 years	8257.00	304.63	3.70	300	
Helen	G. Friesland	Mature	5956.40	244.73	4.11	300	E. Palmer, Ferndale, Penhalonga.
Jean	G. Friesland	3 years	6880.10	246.23	3.58	238	
Meg	G. Friesland	Mature	6945.00	293.69	4.23	253	
Patsy II	G. Friesland	3 years	7263.00	291.37	4.01	268	
Brenda	G. Friesland	2 years	12638.50	402.07	3.18	300	J. D. Parsons, P.O. Box 7, Bulawayo.
Butter Dish	G. Friesland	3 years	7340.10	244.20	3.33	300	
Kimpton	G. Friesland	3 years	10850.00	342.29	3.15	300	
Surprise	G. Friesland	Mature	15393.00	511.31	3.32	300	
Wicky	G. Friesland	4 years	10035.00	301.05	3.00	264	

SEMI-OFFICIAL—(Continued).

Name of Cow.	*Breed.*	*Age.*	*Milk in lbs.*	*B. Fat in lbs.*	*Average % B. Fat.*	*No. of Days.*	*Name and Address of Owner.*
No. 46	G. Friesland	Mature	6299.00	229.57	3.64	300	T. C. Pascoe, P.O. Box 1253, Salisbury.
No. 118	G. Friesland	Mature	8489.00	296.48	3.49	300	
No. 152	G. Friesland	Mature	6148.00	230.81	3.73	300	
No. 178 A	G. Friesland	Mature	5846.00	229.54	3.92	300	
No. 248	G. Friesland	Mature	7457.00	239.65	3.21	300	
Augusta	G. Friesland	4 years	8954.20	311.58	3.48	300	Red Valley Estate, Lushington, Marandellas.
Bettapatsy	G. Friesland	4 years	9534.80	323.97	3.40	300	
Last	G. Friesland	Mature	7276.50	267.85	3.68	300	Mrs. M. Rogers, Bickford, Gwelo.
Mollie	G. Friesland	4 years	8876.70	297.07	3.34	300	W. F. H. Scutt, Maple Leaf, Norton.
Sophia	G. Friesland	Mature	7884.70	262.76	3.33	283	
Gubeni	G. Friesland	Mature	6102.00	265.77	4.35	270	L. F. Sheffield, Orange Park, P.O. Macheke.
Johannesburg	G. Friesland	Mature	5716.50	229.19	4.01	300	
Salome	G. Friesland	Mature	6893.00	238.03	3.45	256	
Effie	G. Jersey	4 years	6891.00	326.69	4.74	300	W. Smith-Baillie, Finevara, P.B. 43, Marandellas.
Star	G. Jersey	2 years	5874.00	290.14	4.94	300	F. Squires, P.O. Box 1052, Salisbury.
Battle Elsie V (P. 25)	P.B. Ayrshire	Mature	7051.00	252.52	3.58	300	J. R. Stewart & Sons, Ltd., Battle Farm, P.O. Shangani.
Battle Fairy IV	P.B. Ayrshire	Mature	6732.00	246.05	3.67	282	
G. 2A	G. Ayrshire	Mature	6369.00	246.62	3.87	271	
G. 21A	G. Ayrshire	Mature	6422.00	231.46	3.60	300	
G. 22	G. Ayrshire	Mature	6828.00	279.13	4.08	267	
Beauty II	G. Friesland	4 years	8656.00	386.93	4.47	300	E. Tapson Trust, Ltd., Lesapi Falls, Rusape.
Chineya	G. Friesland	Mature	7191.00	260.68	3.63	300	
Umtali	G. Friesland	Mature	8573.00	340.07	3.97	281	
Sunshine	G. Friesland	3 years	7029.00	289.28	4.10	300	
Tank	G. Friesland	Mature	8119.00	320.04	3.94	263	
Bolongna	G. Friesland	3 years	7847.00	317.50	4.05	300	
Butterfly II	G. Friesland	3 years	7264.00	284.43	3.92	300	
Escombe	G. Friesland	3 years	6921.00	266.53	3.85	300	
Framassina	G. Friesland	Mature	7555.00	281.70	3.73	255	

July	G. Friesland	Mature	7859.00	273.41	3.48	280	Evelyn Tapson Trust, Ltd., "Lesape Falls," Rusape.
Marina	G. Friesland	3 years	7369.00	294.41	4.00	300	
Matope	G. Friesland	3 years	8302.00	310.85	3.74	300	
Poy Poy	G. Friesland	2 years	8582.00	323.52	3.77	300	
Queen II	G. Friesland	3 years	7690.00	322.35	4.19	300	
Somabula II	G. Friesland	3 years	8449.00	295.57	3.50	300	
Charlie	G. Friesland	Mature	7191.90	259.49	3.61	286	L. Taylor. Box 55, Selukwe.
Chibi	G. Friesland	Mature	9521.40	306.87	3.22	300	
Gwelo	G. Friesland	Mature	9009.00	310.95	3.45	300	
Molly	G. Friesland	4 years	5708.20	234.34	4.11	281	
Nyembesi	G. Friesland	4 years	8802.70	354.54	4.03	300	
Boy	G. Friesland	Mature	7405.00	260.65	3.52	265	A. W. Tennent, Kelvin, Headlands.
Mary	G. Friesland	Mature	7164.40	234.90	3.28	274	
Rosie	G. Friesland	Mature	8423.50	311.42	3.70	300	
No. 13	G. Friesland	Mature	6537.20	232.51	3.56	261	
No. 23	G. Friesland	Mature	6808.90	253.17	3.72	252	
No. 25	G. Friesland	4 years	7486.80	278.61	3.72	275	
No. 36	G. Friesland	4 years	7259.30	257.29	3.55	278	
No. 47	G. Friesland	3 years	7881.50	302.71	3.84	300	
No. 49	G. Friesland	2 years	6148.70	228.44	3.72	300	
No. 52	G. Friesland	3 years	7956.80	292.95	3.68	300	
No. 53	G. Friesland	3 years	7377.80	284.58	3.86	300	
No. 59	G. Friesland	3 years	7552.40	272.82	3.61	288	
No. 83	G. Friesland	2 years	6005.30	231.83	3.86	282	
No. 84	G. Friesland	3 years	6864.00	249.50	3.64	291	
Nurse IV	G. Friesland	3 years	6809.00	295.41	4.34	300	P. S. Timms, Chitora, Rusape.
No. 3	G. Friesland	3 years	5891.00	233.74	3.97	300	
Sybil	G. Friesland	Mature	7183.80	230.51	3.20	300	Martin Tracey, Tawstock, Chakari, P.B. 21, Gatooma.
Tiny	G. Friesland	4 years	9035.00	282.89	3.13	300	Mrs. M. Turnbull, P.O. Box 479, Bulawayo.
Elysoun II	G. Friesland	Mature	10599.00	320.89	3.03	300	R. O. Waldschutz, Box 27, Marandellas.
Grace	G. Friesland	Mature	6843.00	241.80	3.53	300	
Heather	G. Friesland	Mature	6061.00	235.35	3.88	300	
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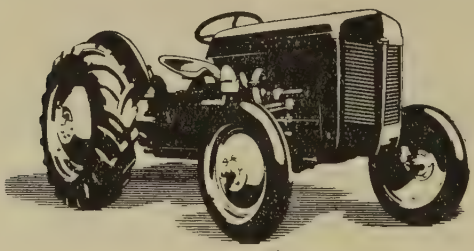

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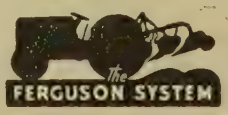

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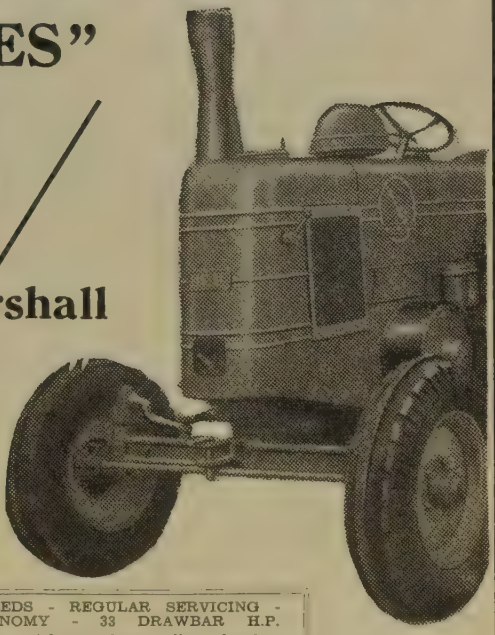

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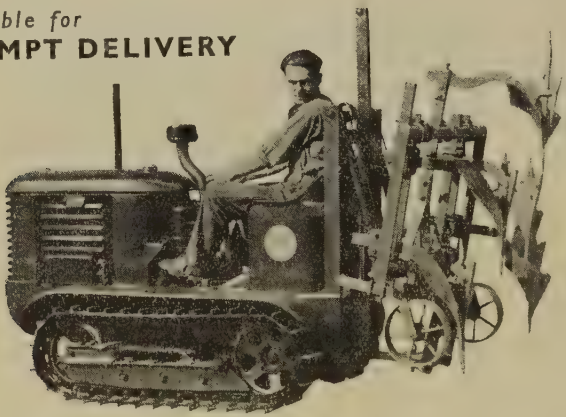

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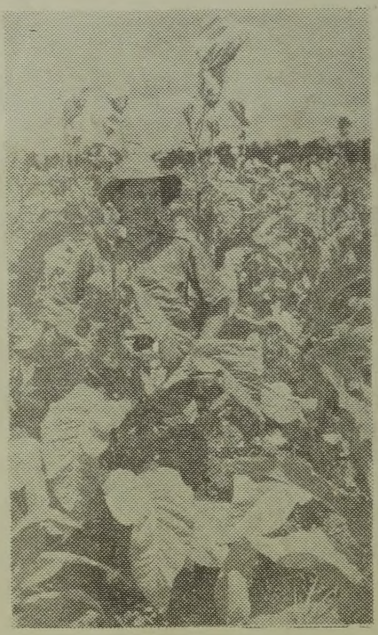

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